

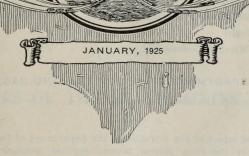


THE LIBRARY
OF
THE UNIVERSITY
OF CALIFORNIA
DAVIS









PUBLISHED QUARTERLY

CALIFORNIA STATE MINING BUREAU

> FERRY BUILDING SAN FRANCISCO

LIBRARY
UNIVERSITY OF CALIFORNIA
DAVIS

CALIFORNIA STATE MINING BUREAU.

EXECUTIVE AND TECHNICAL STAFF

LLOYD L. ROOT State Mineralogist

WALTER W. BRADLEY
Deputy State Mineralogist

MINING DIVISION

C. A. LOGAN, District Mining Engineer	-	-	 Sacramento
C. McK. Laizure, District Mining Engineer -	-	-	 San Francisco
W. BURLING TUCKER, District Mining Engineer	-	- "	 Los Angeles
C. D. HULIN, Geologist	-	-	 San Francisco
FRANK SANBORN, Mineral Technologist	-	-	 San Francisco

DEPARTMENT OF PETROLEUM AND GAS

R. D. Bush, State Oil and Gas Supervisor - - - - San Francisco

NOTE.—A detailed report of the activities of the Department of Petroleum and Gas is issued monthly by the State Mining Bureau, entitled 'Summary of Operations, California Oil Fields.'

CALIFORNIA STATE MINING BUREAU

FERRY BUILDING, SAN FRANCISCO

LLOYD L. ROOT

State Mineralogist

Vol. 21

JANUARY, 1925

No. 1

CHAPTER OF

REPORT XXI OF THE STATE MINERALOGIST

COVERING

MINING IN CALIFORNIA

AND THE

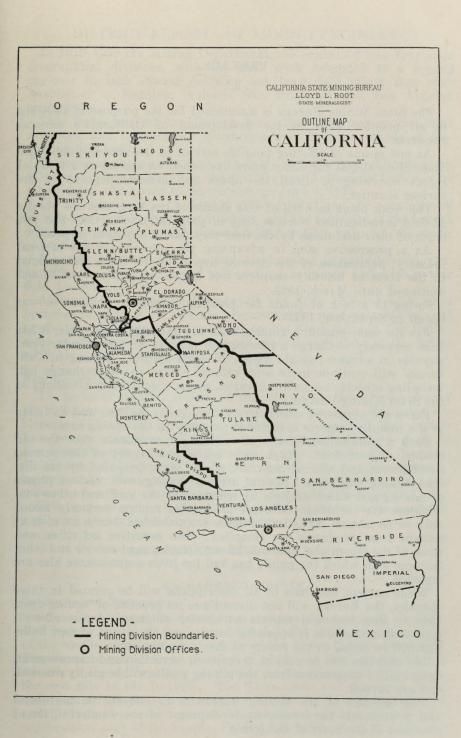
ACTIVITIES OF THE STATE MINING BUREAU



CALIFORNIA STATE PRINTING OFFICE JOHN E. KING, State Printer SACRAMENTO, 1925

CONTENTS.

	Page
DISTRICT REPORTS OF MINING ENGINEERS	1
Sacramento Field Division	1
San Francisco Field Division	23
Los Angeles Field Division	58
Oil Field Development Operations	72
SPECIAL ARTICLES	77
Mining Law	77
ADMINISTRATIVE DIVISION	122
DIVISION OF MINERALS AND STATISTICS	123
Statistics	123
Museum	124
Laboratory	124
LIBRARY	126
PRODUCERS AND CONSUMERS	132
EMPLOYMENT SERVICE	133
BUREAU PUBLICATIONS	I



PREFACE.

The State Mining Bureau is maintained for the purpose of assisting in all possible ways in the development of California's mineral resources.

As one means of offering tangible service to the mining public, the State Mineralogist for many years has issued an annual or a biennial report reviewing in detail the mines and mineral deposits of the various counties.

The weak point in work of this character has been that the results of field investigations were so long in preparation that they had lost much of their usefulness by the time they finally appeared in print.

As a progressive step in advancing the interests of the mineral industry, publication of the Annual Report of the State Mineralogist in the form of monthly chapters was begun in January, 1922, and continued until March, 1923.

Owing to a lack of funds for printing, quarterly publication was

begun in September, 1923.

For the same reason, beginning with the January, 1924, issue, it has been necessary to charge a subscription price of \$1 per calendar year, payable in advance; single copies, 25 cents apiece. 'Mining in California' will continue to be sent without charge to our exchange list, including schools and public libraries, as are also other publications of the State Mining Bureau.

Pages are numbered consecutively throughout the year and an index to the complete reports is included annually in the closing number.

Such a publication admits of several improvements over the old method of procedure. Each issue contains a report of the current development and mining activities of the state, prepared by the district mining engineers. Special articles dealing with various phases of mining and allied subjects by members of the staff and other contributors are included. Mineral production reports formerly issued only as an annual statistical bulletin are published herein as soon as returns from producers are compiled. The executive activities, and those of the laboratory, museum, library, employment service and other features with which the public has had too little acquaintance also are reported.

While current activities of all descriptions will be covered in these chapters, the Bureau will not discontinue its practice of issuing from time to time technical reports on special subjects. A list of such reports now available is appended hereto, and the names of new bulle-

tins will be added in the future as they are completed.

The chapters will be subject to revision, correction and improvement. Constructive suggestions from the mining public will be gladly received, and are invited.

The one aim of the Mining Bureau is to increase its usefulness and to stimulate the intelligent development of the wonderful, latent resources of the State of California.

DISTRICT REPORTS OF MINING ENGINEERS.

In 1919-1920 the Mining Department was organized into four main geographical divisions, with the field work delegated to a mining engineer in each district working out from field offices that were established in Redding, Auburn, San Francisco and Los Angeles, respectively.

This move brought the Bureau into closer personal contact with operators, and it has many advantages over former methods of con-

ducting field work.

To continue this system most effectively with the limited funds available for the present biennium, the Redding and Auburn field offices were

consolidated and moved to Sacramento on June 1, 1923.

The boundaries of each district were adjusted and the counties now included in each of the three divisions, and the locations of the branch offices, are shown on the accompanying outline map of the state. (Frontispiece.)

Reports of mining activities and development in each division, prepared by the district engineer, will continue to appear under the proper

field division heading.

Although the petroleum industry is but little affiliated with other branches of mining, oil and gas are among the most valuable mineral products of California, and a report by the State Oil and Gas Supervisor on the current development and general conditions in the state's oil fields is included under this heading.

New County Reports.

The series of separate reports on the mines and mineral resources of the different counties, that together comprise the State Mineralogist's Reports XIV to XVII, inclusive, in the case of many of the counties have become exhausted. Those still in stock are in need of revision. It has been thought advisable, therefore, beginning with the January, 1925, issue of 'Mining in California,' to make the district engineers' reports in the form of a complete general report on the mines and mineral resources in one or more of the counties in each district.

This program will be followed in succeeding numbers of the quarterly

until each county in the state has been covered.

SACRAMENTO FIELD DIVISION.

C. A. LOGAN. Mining Engineer.

SACRAMENTO COUNTY.

Geography and Topography.

Sacramento County is almost in the geographic center of the state, and lies principally in the Great Central Valley, with the eastern part of the county rising into the foothills of the Sierra Nevada Mountains. The elevation varies from thirty feet above sea level at Sacramento (Southern Pacific depot) to about nine hundred feet above the sea on the east side in the foothills. The Sacramento and American rivers unite just northwest of Sacramento city limits, the former flowing south and forming the western county line. Cosumnes River traverses the southeastern part of the county, flowing into Mokelumne River on the southern county line.

Transportation and Power.

The county and capital city are served by two transcontinental railways, the Western Pacific and Southern Pacific, which cross the county from north to south. The Central California Traction Company, running from Sacramento to Stockton, gives connection with the Santa Fe system, and the San Francisco-Sacramento electric line runs southwest to Oakland and San Francisco. A third electric interurban line, the Sacramento Northern, runs north as far as Chico. Three regular steamer lines ply between Sacramento and San Francisco on the river, giving freight and passenger service, besides which there are numerous other river cargo carriers. Two large power companies, Pacific Gas and Electric Company and Great Western Power Company supply electric power and the former company and Sacramento Gas Company supply gas. Transportation and power needs are thus seen to be well supplied. State highways radiate in all directions from Sacramento.

Mineral Resources.

Sacramento County has been an important gold-producing district for a long time. Previous to the enactment of anti-debris laws there was considerable hydraulic mining in the Folsom district and the gold production from this source and from drift mining, was as high as half a million dollars a year. In 1899 gold dredging began and gold production reached its peak between 1909 and 1917, the maximum yield being over two and a half million dollars in 1913. From now on, production from the gold dredgers will decline rather rapidly.

As a by-product industry, utilizing the waste rock piles of the dredged land, the rock-crushing industry has become important and has grown rapidly with the increased use of cement. Sand and gravel are also dredged in large quantities from the American River bed.

Brick, tile and a great variety of clay products are produced, using local clay mostly. Natural gas is supplied for domestic use, in part from wells. Granite is quarried, and platinum metals and silver are recovered as by-products of dredging.

In the eastern part of the county there are clay deposits which have remained undeveloped because of lack of cheap transportation. This is the only part of the county that is not covered by sand and gravel, and the older rocks are exposed, showing numerous quartz veins and stringers which have yielded many gold pockets. Finally the sand and finer gravel remaining at the bottoms of the dredger rock piles, after the upper portions have been removed and used for crushed rock, may one day be worked over for gold that escaped from the original operations.

CLAY INDUSTRY.

The business of manufacturing clay products has become an important one in the county and a great variety of building materials and household wares are being made. Local clays as well as white clay and sand from Placer and Amador counties are used.

Cannon & Company's Pottery (formerly Sacramento Clay Products Company). Owner: Cannon & Company, a close corporation. D. A. Cannon, president and general manager. Main office, 400 Forum Building, Sacramento. Pottery and clay beds are at Ben Ali siding, four miles from Sacramento, on what was formerly a part of Rancho

del Paso, adjoining the Southern Pacific main line and state highway. There are about two hundred acres in the holdings.

About sixty per cent of clay is mined on the property. White clay and sand are brought from Lincoln and Ione deposits for making firebrick and are mixed in desired proportions with the local clay for

making other products.

The clay on the property is a firmly consolidated yellowish brown sandy clay, red-burning, and locally called 'hardpan.' It is covered by a layer of reddish sandy loam, which is worked and marketed separately for molding sand (see *post*). The 'hardpan' layer varies in thickness but the entire bank is similar in quality, and is worked to a

depth of fifteen to twenty feet.

Clay is dug by a steam shovel and horse scrapers, loaded in cars and hoisted to the plant, where it is dumped and aged under cover. It is fed by an auger feed to two dry pans for grinding, after which a bucket elevator lifts it to a Hum-Mer electric screen, screening to desired size depending on the product to be made. The clay then passes to storage bins, pug mill, and brick or tile machines. The stiff mud process is used. The products manufactured include face brick, interlocking and hollow tile, fire brick, hollow brick, Roman brick and other special shapes and sizes. The shrinkage of the local clay is one in thirteen, which is low compared with the white clays used, and shrinkage of different products varies with proportions of the clays employed. Fusibility of the firebrick is above 3000 degrees Fahrenheit and the face brick, 2100 to 2200 degrees Fahrenheit. For burning the brick and tile there are five down-draft round kilns, each with a capacity of 70,000 to 80,000 bricks. The bricks are burned five days and tile two and one-half to three days. Clay working machinery is operated from a main drive, using a 200-h.p. electric motor, and crude oil fuel is used for the kilns and steam shovel. There is a spur track to the plant from the railroad main line. Thirty-five to forty men are employed and the plant has a capacity of 1000 to 1200 tons a month.

Interlocking tile is used for bearing walls. This tile and the face brick have been used in the new California State Life Building and in

other large buildings recently erected in Sacramento.

Bibl: State Mineralogist's Report XV, p. 404.

Natomas Company of California. An interesting possibility, and the promise of developing another by-product of gold dredging operations in the county, has been brought out by recent experiments by this company. Muddy water, which must be kept out of the river, has been a serious problem. Lately, tests have shown that this water in the dredge ponds during operation carries 6% to 10% solids by weight, and the material is so fine that little of it is coarser than 200 mesh, ranging from that size up to 20,000 mesh as tested by special apparatus. Chemically, it is a clay, being the finer-sized particles of the reddish 'hardpan' deposit of the older terraces formerly occupied by the river. The colloidal constituents are noticeable even after long standing.

This clay is of interest to potters because of its extreme fineness and some shipments have already been made to a pottery for further tests. It will probably be recoverable cheaply enough to permit marketing at

a reasonable price.

MINERAL PRODUCTION OF

Year	Gold.	Silver,	Plati	inum	Brick		
	value	value	Ounces	Value	M.	Value	
1880	\$342,514						
1881	425,000	\$1,000					
1882	400,000	V1,000					
1883	480,000						
1884	270.000						
1885	353,522						
1886	280,000						
1887	158,526	176					
1888	150,000	110					
1889	210,075						
1890	193.585						
1891	142,830	4	*				
1892	121.900	4					
1893	90,091				11.250	050 050	
1894	70.326					\$56,250	
1895	145,873				13,125	65,625	
1896	133,050				8,700	44,200	
1897	93,050				3,100	16,700	
1898	57,301				11,000	44,000	
1899	115,906				15,600	93,600	
1900	176,007	2473			8,900	53,400	
1901	229,034	2253			12,236	62,180	
1902	425,894	330			10,492	78,198	
1903	335,646	234			15,000	120,000	
1904	419,287	75			4,500	20,000	
1905	668,382	206	40	\$700	18,000	130,000	
1906	986,624	3,640	11	200	12,000	108,000	
1907	790,973	2.034			16,078	128,62	
1908	1,166,055	1,621			7,936	63,491	
1909	1,669,814	2,856					
1910	1,396,874	4,606					
1911	1,812,826	3.047			13,017	76,57	
1912	1,712,587	3,544			26,073	161,533	
1913	2,503,633	3,406			22,535	144,191	
1914	2,164,491	3,481	223	7,108	22,862	160,923	
1915	2,131,813	3,151	196	6,217	9,920	82,973	
1916	1,833,855	3,578	195	8,892	8.924	91,618	
1910	1,000,000	0,010	100	0,002	0,021	02,020	
1917	1,919,581	4,487	157	12,453	and	tile 122,886	
1918	1,694,121	4.637	3			79,312	
1919	1,714,79	5,276	3		3		
***************************************	2,122,10	0,210					
1920	1,575,033	4.534	3			248,433	
1921	1,690,662	5,254	3			216,402	
1922	1,350,749	3,392				259.263	
1923	1,331,227	2,566				327,636	

Totals	\$35,933,513	\$67,861	3822	\$35,570		\$3,061,008	

¹Includes crushed rock, rubble, rip-rap, sand, gravel, paving blocks.

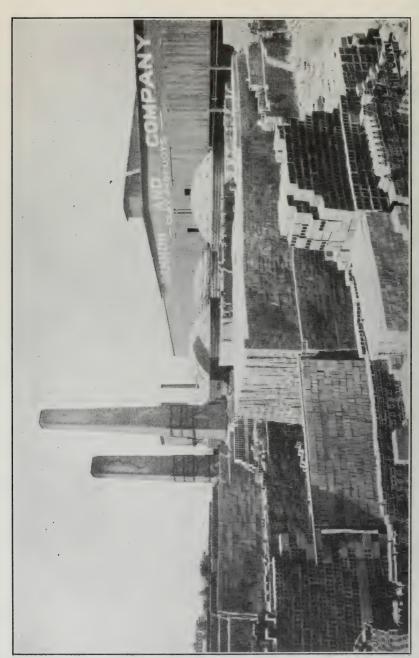
²Recalculated to 'commercial' from 'coining value' as originally published.

³See under 'Unapportioned.'

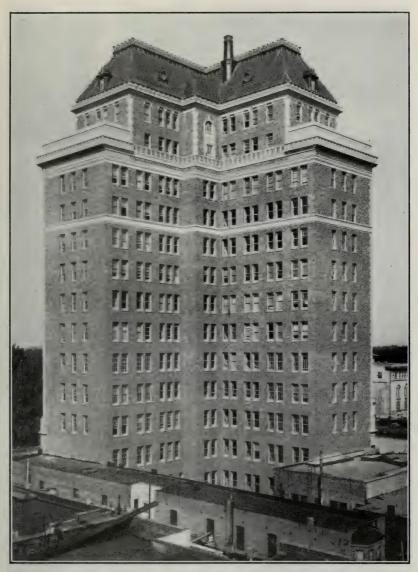
⁴State Prison use, value estimated, as none reported.

SACRAMENTO COUNTY, 1880-1923.

Granite		Natur	al gas	Miscel- laneous	Miscellaneous and unapportioned				
ubic feet			stone ¹ , value			Substance			
75,000	4\$35,000								
85,000	445,000								
				\$12,018					
207,845	62,339			28,074		\$1,500	Pottery clay		
4,840	4,000	15,000	\$12,000	14,137			,		
1,524	1,145	12,000	10,000	13,105					
2,137	3,139	11,750	11,750	14,157		010	G		
2,635	2,882	00 550	04.000	7,926		316	Copper		
288	136	38,550	31,200	19,380					
20,471	2,222	31,680 39,200	30,518 39,200	18,176 22,103					
5,164 4,327	4,458 1,614	43,564	43,564	32,386					
10,905	1,779	60,225	52.874	18.141					
26,105	4,625	60,225	52,874	13,936					
44,151	44,151	55,000	55,000	151,477					
31.660	23.745	60,000	60,000	235,210		314,438	Unapportioned, 1900-1909		
68,684	59,947	49,203	49,203	164,592		011,100	Chapportioned, 1500-1500		
45,630	2,307	90,000	83,890	131.037					
20,000	2,001	100,000	96,000	197,733					
		72,000	36,000	238,476					
		80,000	40,000	253,235					
		108,000	54,000	284,127			·		
		3		194,718	1 227 lbs.	16	Lead.		
						46,000	Pottery clay, natural gas.		
				199,839	}	27,000	Other minerals.		
					310 tons	410	Pottery clay.		
		1		262,689		61,235	Natural gas, platinum, pota		
		3		276,732	\	113,000	Clay and clay products.		
					\	61,395	Natural gas and platinum.		
		3		180,563		57,591	Natural gas and platinum.		
	39,469	3		386,911		56,196	Natural gas and platinum.		
	51,500			412,667		111,991	Natural gas and platinum.		
	30,740	3		649,939		93,907	Natural gas and platinum.		
	\$420,198	3926,397	\$758,073	\$4,433,484		944,995			



Plant of Cannon & Company at Ben Ali siding, near Sacramento, showing kilns, stockpiles and main building. (Photo by courtesy of the company.)



California State Life Building, Sacramento, showing rear walls faced with Cannon & Company's face brick. This company manufactures 132 shades of face brick, and the numerous shades give constantly changing effects at different times of day. (Photo by courtesy of the company.)

Panama Pottery. Owner, Panama Pottery Company, Incorporated, a close corporation. Victor Axelson, president. Andrew Anderson and Gustav Johanson, principal owners. Address: Post office box 797, Sacramento. Plant is just south of Sacramento city limits near Twenty-first street road.

This company owns no clay deposits at present, but buys red-burning clay locally and white clay from Lincoln and Ione. They manufacture



Fancy garden pottery, manufactured by Panama Pottery Company, Sacramento.

all kinds of household stoneware, including jars, water coolers and filters, jugs, mixing bowls, pitchers, etc. They also make fancy garden pottery and common and fancy flower pots. The company has just received patents on a new one-piece mold for embossed flower pots and are exclusive makers of this line which is made from white clays, burning cream color.

Clay for the various products is crused in a dry pan and elevated to a shaking screen, 30-mesh. It is then tempered and run through the pug mills, aged and run through the pug mill again. After molding, it stands for a short time on shelves and is taken thence to the dryer. White ware is burned 48 to 52 hours at a temperature of 2,200 degrees Fahrenheit, and red ware 37 to 42 hours at a temperature of 1800 degrees Fahrenheit.



Panama Pottery Company's Plant, near Twenty-first street road, just south of Sacramento.

Equipment at the plant includes two pug mills, a drypan, glaze grinder, one flower pot machine, three jolly wheels, shaking screen, and two downdraft kilns with a total capacity of 16,000 gallons of stoneware. Crude oil is used for firing the kilns, and electricity for power. Sixteen men are employed. About ten days are required for a complete run, from setting to the time of drawing. The market for the goods is mostly in central California and deliveries are nearly all by automobile truck.

Sacramento Brick Company (formerly Riverside Brick Yard). A stock company, subsdiary to Sacramento Navigation Company. W. P. Dwyer, president. A. J. Foster, general manager. H. K. Johnson, secretary. Main office, Front and N streets, Sacramento. Brick plant is three miles south of Sacramento city limits, near Sacramento River.



Plant of Sacramento Brick Company, near Sacramento.

The company makes common brick exclusively. The deposit is clay, sand and loam, with no hardpan, and is worked about 16 feet deep by a steam shovel and drag-line scraper. Clay is loaded into four-ton side dump cars and hauled in trains by dinkey locomotives to the plant, where it is dumped into rolls, elevated to the pug mill and tempered. It passes thence to a soft-mud brick machine where bricks are pressed and cut and dusted with ground red grog from an outside grog grinder and storage bin. From the brick machine the bricks pass by wire cableway to steam rack dryers, where they are dried about 18 hours. They are then burned in open-draft field kilns for seven days at a temperature of 1,700 degrees to 1,750 degrees Fahrenheit. The kilns contain from 400,000 to 500,000 bricks each. Shrinkage in burning is about 6%. The plant has a daily capacity of sixty thousand bricks and employs a crew of sixty men. Crude oil is used for burning bricks. for the steam shovel and locomotives, and electric power for operating machinery. The direct operation of the brick machine requires only three or four men.

The company has another plant between the present site of operation and the river, but this has been abandoned. It was formerly operated at a daily capacity of 125,000 bricks during the dry season only, but the present operations are carried on steadily.

Bibl: State Mineralogist's Report XV, p. 403.

Muddox Pottery. Thirtieth and L streets, Sacramento. H. C.

Muddox Company, owner. H. C. Muddox, president.

This company operates a plant for the manufacture of sewer pipe and chimney ware. They own some land at Carbondale, Amador County, where they dig clay, and also buy some common clay locally.

FUELS.

PETROLEUM.

Several wells have been drilled in Sacramento County in search of oil but to date none of these have been productive. In general, it may be said that we have no evidence of a positive character one way or the other, and there is no basis at present for any final decision as to whether or not oil underlies the Sacramento Valley. The wells that have been drilled have not been deep enough to penetrate the entire thickness of sedimentary strata deposited in the valley, and the fact that they have not encountered oil is not proof that oil does not exist. On the other hand, the valley is so deeply filled with sand and gravel of relatively recent age, that if oil-bearing formations do exist, and if the structure of these formations is such as to favor the retention of oil in commercial quantities, we have no means of proving it except by drilling. Every foot of the valley is covered by a thick layer of recent formations, which completely covers the older sedimentary formations and hides every hint of structure. The thickness of these recently deposited beds is uncertain in the valley proper, as wells drilled about 3000 feet deep in and near Sacramento have not penetrated the entire series of sedimentary beds. Due to the scarcity of fossils in these beds and the fact that shell remains and casts coming out of the wells are smashed to small bits by the drill, no characteristic fossils have been identified, so far as the writer has been able to find from inquiries made in the case of all wells drilled in later years to any important depth. The physical appearance of sand and shale coming from these wells (which is not a safe criterion) suggests that the lower portions of several of the deeper wells are in Cretaceous beds. Considerable stress has been put by promoters on surface features. These features are probably the result of erosion by modern streams and have no connection with underground structure in the valley proper. So far as could be learned, the gas encountered in many wells in this valley is 'dry' marsh gas, giving no sign of the presence of petroleum.

Associated Development Company drilled two wells one-half mile northwest of Clay station in the southeast corner of the county. Mitchell No. 1 well reached a depth of 1900 feet, where work was stopped without result. Mitchell No. 2 well was drilled to a depth of 2963 feet and some cuts of oil in chloroform were exhibited, but no oil was brought in.

The surface in this district is mantled by gravel and sand. The two wells are upon a slight ridge with its long axis striking northwest, but this ridge is probably an erosion feature. The Ione beds are the only ones positively identified, but the physical character of sand brought up is similar to the Cretaceous, in which the holes are probably bottomed.

Other wells were drilled a few years ago near Clay. One of these struck a pocket of gas which was ignited and burned for some time. No

oil was brought in, although a report was given out that traces of paraffin base oil had been found. No samples of this were available when the writer visited the property, although the derrick showed the effects of the gas fire that had partly consumed it. It is presumed this gas was the 'dry' natural gas found in so many places in the valley.

Central Petroleum Company has under lease and option 256 acres of land in Lot 15, Sec. 53, T. 9 N., R. 6 E., about a mile and a half east of Del Paso Park. A prospect well has been drilled with a rotary rig to a depth of 2863 feet and has just been cemented (January 13) preparatory to a test of a reported oil sand near the bottom of the well. The date of test will be a few days after these notes go to the printer, precluding the possibility of giving the result of tests in this report.

NATURAL GAS.

The fact that numerous wells drilled in the Sacramento and San Joaquin valleys have brought in flows of gas, has been cited by many as an indication of oil, but none of these gas wells has ever given any oil indications, the gas being methane principally, with small amounts of inert gases such as nitrogen and carbon dioxide. Gas has been encountered in Sacramento County at depths ranging from a few hundred feet to 3000 feet.

Sacramento Gas Company. Main office, 916 Sixth street, Sacramento, Jens C. Jensen, manager. This company is at present supplying a large number of customers with gas from seven wells, located near Eighth avenue and Sacramento River, near American River at the end of Twenty-third street and along Sacramento River near Riverside boulevard. The wells vary in depth from 1700 feet to 3000 feet. They are artesian wells, giving immense flows of warm salt water, from which the gas separates at the top of the wells and is caught in traps and stored in large containers. Some gas is manufactured, as the natural supply is not sufficient to fill all demands.

The manager states that there has been no dimunition in the amount of gas flowing from the wells in the past ten years, but that, in fact, the present total output of seven wells is considerably greater than the former supply from eight wells. Output has been stimulated artificially, and is approximately 300,000 cubic feet daily now. It appears that the productive life of the well depends largely upon the care with which it is cased and the life of the casing. Uncased wells choke up with sand usually within a few years after they are drilled. The gas issuing from these wells is stated to be 'dry' marsh gas, averaging 84% methane, the balance being nearly all nitrogen. The product is clean and has a high heating value. The flow of gas is said to decrease in winter because of increased water pressure.

Bibl: State Mineralogist's Report XV, p. 405.

GOLD.

Sacramento is one of the leading gold-producing counties in the state, by reason of the dredging operations, which are now carried on by one company. A little drift mining and pocket mining is carried on, but the resulting gold production is small and irregular.

²⁻³⁷⁰⁸³

DREDGING.

The land suitable for gold dredging in this district extended from Blue Ravine, six miles above Folsom, along the present and former courses of American River to nine miles below Folsom, and is three miles wide in places, with most of the payable gravel on the south side of the river. Both the present river and the ancient courses and terrace levels have been worked. The ground varies in depth from 20 to 70 feet, but at present is being dredged 30 to 55 feet deep. The upper portion of the terrace gravels is covered by hardpan and clay, the entire bank being clavey and hard to dig.

The pioneer dredger was put in operation in this field in April, 1899, by the Colorado Pacific Gold Dredging Company. It was a Risdon boat, with buckets of three and one-fourth cubic feet capacity. Four companies followed and worked until January, 1909, when they were consolidated under the corporation name of Natomas Consolidated of California. The Ashburton Mining Company finished its ground in 1913. The only other remaining company, the Wilkes-Barre Dredging Company, sold out to the Natomas Consolidated (now Natomas Company of California) in 1916, leaving that firm alone in the field.

A tabular history of Sacramento County dredgers was published in the Fifteenth Report of the State Mineralogist. Also some notes on the subject were published in 1917 in Bulletin 85 of the State Mining

Bureau.

In 1916, eleven dredgers were in operation in this district, and in 1917 about twenty million yards of gravel were handled by ten dredgers, compared with six boats, handling about thirteen million cubic yards

per annum at present.

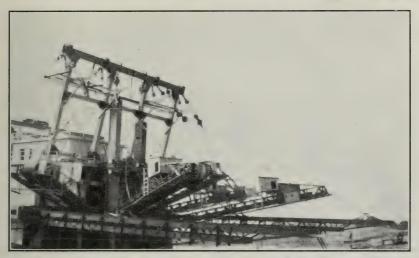
. Besides the ground dredged out, and that controlled by the Natomas company, there remain a few small parcels of land in the district that might be profitably dredged if the acreage were large enough to justify installation of a dredger. W. H. McDerby of Folsom has one such small property. There is also some ground left in Blue Ravine, which is said to be held by parties not desiring to sell for dredging. Blue Ravine is a shallow draw extending from near Mormon Bar, on the river above Folsom, southerly across the region east of the town and is underlain by an old gravel channel, which was partly drifted out in early days.

Some dredging has also been done on Cosumnes River between Bridge House and Michigan Bar. The Indiana Gold Dredging Company operated for several years there. They had an old dredger from Oroville which had 75 buckets of four cubic feet capacity and dug 27 feet below water. The ground was about 30 feet deep, of which the upper 15 feet were reported to be unprofitable to work. This overburden is similar to the terrace deposits now being dredged by the Natomas company, and equally hard to dig. The ground averaged 10 cents a yard in 1917. The exact acreage of possible dredging ground left here is unknown, but is believed to be not more than enough for one small dredger, as only 160 acres had been proved and part of this was worked out.

¹ California State Mining Bureau Bulletin 85, p. 27, et seq.

Natomas Company of California. Emery Oliver, general manager. Forum Building, Sacramento; L. D. Hopfield, manager of gold dredging department, Natoma; R. G. Smith, mining engineer. The repair shops and headquarters of the dredging department are at Natoma.

This company is now operating six dredgers. The ground near Folsom and Natoma and on the present river has been finished and all



Rebuilt dredger, designed to leave land practically level after dredging. Natomas Company of California.



Detail, showing method of operating. Land-leveling dredger near Natoma, Sacramento County.

operations are now two to three miles south and west of Natoma and a mile southeast of Citrus, in the older and higher terrace gravel of quaternary age deposited 60 to 100 feet higher than the present level of the river and a mile and a half or more south of its present course.

The gravel is covered by hardpan and is mixed with elay, the whole bank having a reddish color and containing so much clay that it stands without caving and is much more expensive to dig than the present-river deposit. The boulders are more or less decomposed, indicating great age. Two dredgers are digging to a depth of 30 feet, two about 50 feet and two 55 feet below water level. One dredger was reconstructed and

put on this ground in 1919, one in 1922, and one in 1924.

The tailing disposal equipment on all the dredgers but one has been remodeled so that the land is left approximately level after dredging. This is accomplished by dumping cobbles near the dredge, and running the finer tailing out farther, covering the coarse rock. (See illustration.) When this equipment was first installed, it was hoped that the land would be left in shape so it could be planted, and some small areas have been set out to trees and vines, but results were not up to expectations, as the finer sediment could not be held where wanted. Muddy water has been a serious problem, as it has to be kept out of the river as much as possible. The area of proved dredging land has been increased since 1917, but while the ultimate exhaustion of the placers has thus been postponed, the boats will be retired at intervals beginning in 1926 or 1927.

Three of the dredgers are equipped with Neill jigs and the recovery with these has been improved. The beds have been flattened and the velocity of approach of the feed to the jigs has been lessened. It has been found that, barring accidents, and breakage the most of the dredger machinery will last about as long as there is any ground left in the field. The wooden hulls, made from Oregon pine, last about ten years, one exception at Oroville having lasted eighteen years. A steel hull that had been used twelve years was recently moved, repaired and set up again with a promise of lasting another ten or twelve years. The minimum operating cost at present is five and one-half cents to six cents a yard, the average being six and one-half cents. The cost of operation in this district is much higher than at Oroville, due to greater amount of electric power used and loss of capacity because of muddy water and trouble in disposing of it.

The power bill for a dredger with 15-cubic-foot buckets, handling an average of 350 cubic yards an hour in this district, is reported by the company to average \$1,500 a month more than for the same size dredger in the Oroville district, digging an average of 357 cubic yards an hour. A dredger digs about three-fourths as much in a year in this clayey terrace gravel as it could in the loose present-day river gravel. True bedrock has not been reached in this part of the district, the dredgers

digging to a false bedrock of lava ash.

The dredgers handle, monthly, from 150,000 to 225,000 cubic yards each and a total per annum of about 13,000,000 cubic yards. About 250 men are employed in the dredging department.

Bibl: State Mineralogist's Report XV, pp. 405-413.

State Mining Bureau Bull. 85, pp. 20, 21, 27, 29, 97-98; Bull. 57, pp. 200-204.

U. S. Bureau of Mines Bull. 127, pp. 95, 99, 139-141, 164-174, 186.

DRIFT MINES.

This kind of mining has nearly ceased in the county, although a few men still earn a little in this way. There are a few places of small acreage left by the dredgers that might be drifted. It is also possible that some of the deeper ground, below the level reached by dredging, carries here and there a pay lead. But the few recent efforts to find the remaining sections of a deep 'blue lead' have failed.

Buckeye Flat Mining Company. J. J. Smith et al., owners. Property is on Alder Creek, one mile west of Natoma. George White and M. Tucher are in partnership with the owners and are working on the

property.

An outcrop of pay gravel was discovered in the bank of Alder Creek, and a prospect shaft was sunk a few hundred feet east of this, just north of the state highway. At a depth of 12 feet they entered the gravel which is said to prospect well for a thickness of 4½ feet. A small headframe was put up, a gravel yard and sluices built, and a length of about 30 feet has been drifted and the gravel will be washed as soon as water is available. A pump and engine are being installed to pump water to sluices from Alder Creek, which passes near the shaft. Six hundred feet northeast of this shaft, another was sunk 40 feet deep, encountering similar prospects at a depth of 20 feet. This is underlain by gray lava ash and cobbles.

Cecilia Barrett, 170 East Cleveland Avenue, Stockton, owns a placer mining property of about 35 acres in the SW1 of Sec. 1, T. 7 N.; R. 8 E.; and the E¹/₂ of NE¹/₄ of Sec. 2, T. 7 N., R. 8 E., near Michigan Bar. This was formerly known as the Martin Welch claim.

Little interest is shown by landowners in the foothill section of this county in mineral possibilities of their lands, and such lands are devoted

for the most part to winter grazing.

QUARTZ OR LODE MINES.

For a width of three to four miles along the easterly county line, the older rocks of the bedrock series are exposed as the valley passes into the rolling foothills. The westerly members of this rock series are diabase, amphibolite, and quartz diabase, followed on the east by beds of Mariposa black slate with a total width of one to two miles. At places in the slate, and on the east of it, amphibolite and diabase recur.

Forming an interesting feature, and not shown on the geologic map, are the dikes which traverse the black slate beds, having the same strike as the slate laminae. These are basic dikes, carrying considerable pyrite and usually altered. Associated with them are gold-bearing quartz veins and stringers. The slate, dikes and larger veins strike northwest and dip east. The dikes where fresh are apparently diabase. Cross stringers are in evidence where the dikes widen or have been stripped. Rich pocket shoots occur in the quartz and dike material evidently where cross stringers or zones intersect the main belt. The amphibolite schist on the east or hanging wall side of the black slate also carries these pocket deposits, some in small frozen bunches of quartz. and some apparently in joints in the schist itself.

On the E. L. Butler Ranch, adjoining the Mills-White Rock road in Sec. 20, T. 9 N., R. 8 E., considerable surface mining and shallow work

has been done in the slate and schist.

On the M. E. Strait Ranch, ten miles south of Folsom in Sec. 4, T. 8 N., R. 8 E., is the site of the early-day placer mining camp and stage station called Walltown. The ravines, depressions and hillsides as high as water could be brought, were mined off with rockers and sluices. The deposit was the material from the erosion of the slate, quartz and amphibolite in the vicinity and had not been transported or water worn. It was shallow, not usually over two or three feet deep, and was stripped down to the hard rock.

On this ranch several shallow shafts have been sunk and a number of moderate-sized pockets found. The best of these was along a vein at the contact of a dike and the black slate. The main vein dipped east and the pocket shoot pitched south in the plane of the vein, evidently being along the intersection of a south-dipping vein striking east, with the main vein which strikes northwest. This shoot was followed down about thirty feet and mint receipts show a production of over \$8,200 from it during 1916, when the last work was done. Most of this was recovered by use of a mortar.

There is an old two-stamp quartz mill, several gasoline engines, small air compressor, jackhamer drill, and blacksmith shop on the property which contains 120 acres. Address Carl D. Strait, Folsom.

GRANITE.

Folsom Granite Quarry is within the grounds of the state prison on the east bank of American River just upstream from Folsom. The rock is granodiorite. The quarry is operated by the prison authorities, using convict labor, and a great deal of the stone has been used in the prison buildings, walls and other works on the property, as well as for railroad ballast.

Bibl: State Mineralogist's Report XV, p. 416; X, p. 511.

MISCELLANEOUS STONE.

GRAVEL, CRUSHED ROCK, SAND.

American River Sand and Gravel Company. W. S. Hatch, president, San Francisco. Home office, Perkins, Sacramento County. G. S. Tyler, vice president and general manager at plant. This is a close corporation operating a plant near Mayhews on the Placerville branch of the Southern Pacific Railroad. They produce crushed rock, screenings,

sand for concrete and plaster, and pea gravel.

The deposit is an old back channel of American River. Digging is done with a Brownhoist crane with 1½-cubic-yard bucket, which loads the sand and gravel into a 6-yard car. This is hauled by a Plymouth gasoline locomotive one-fourth mile to the plant and hoisted in a counterbalanced skip to the top of the plant, where it is screened and the cobbles over $3\frac{1}{2}$ inches are returned to the ground to a Buchanan crusher. A sand jacket on the first screen diverts the sand and pea gravel. It was a problem to wash the sand clean enough to use for plaster. This was solved by installing Butters distributors, which have been yielding an excellent product.

· After removal of the sand and crushing of the large oversize, the rock is re-screened, the oversizes going through a Symons disc crusher, and the different sized products are stored in bins in the lower part of the building, and over a spur track where railroad cars are loaded.

Coarse crushed rock is used for railroad ballast, and crushed rock up to 14-inch size for concrete work. Topping sand or gravel, from one-eighth to three-sixteenths inch is used for topping concrete surfaces, and washed sand is used for plaster and concrete. The plant employs 15 men and has a capacity of 500 cubic yards a day. Besides the equipment mentioned, and the numerous trommels, elevators and conveyors, there is a dragline scraper which has been used in working the property.



Plant of American River Sand and Gravel Company, near Mayhews, Sacramento County.

Capital Sand and Gravel Company (formerly Sacramento Sand Company). Office at plant, which is on the north bank of the American River near Twelfth street bridge.

Sand is raised by a 6-inch sand pump from behind a sand bar in American River. The product from the pump is discharged upon a stationary inclined screen at the top of a tower 75 feet high. Coarse rock and debris are screened off, and clay and mica are floated off through an overflow below the screen. The sand runs through pipe to



Fairoaks Plant of Coast Rock and Gravel Company, near Fairoaks.

a storage pile over a tunnel into which trucks can drive and be loaded by gravity. Gravel is dug by drag-line scraper from Arcade Creek, eleven miles northeast of Sacramento.

Most of the production is delivered direct to customers in Sacramento and vicinity by truck. As many as 13 trucks are used for hauling in the dry season, when about 20 men are employed, but the force is smaller in winter. The sand pump is mounted on a barge and operated by electric motor. It has a capacity of about 35 cubic yards an hour.

Coast Rock and Gravel Company (formerly Natomas Company No. 1 Plant). This company in 1920 leased from Natomas Company of California the rock deposits left from gold-dredging operations in the Fairoaks-Folsom district and the latter's large rock crushing and sizing plant one-half mile southeast of Fairoaks. Main office of company, 500 Call Building, San Francisco. Fred Wood, president; A. D. Hadsel, operating manager; William Hathaway, superintendent of Fairoaks plant.

The plant was described in the Fifteenth Report of State Mineralogist, since which time there have been few changes in equipment or mode of operation. The upper portion of the rock piles consists mostly of cobbles and pebbles, the sand and silt having settled to the bottom. Only the coarser, upper part of the piles is worked, leaving the bulk of finer material. A steam shovel digs and loads the rock into 5-ton cars which are hauled in trains of seven cars by dinkey locomotive a mile or more to the plant. The cars dump to a large belt conveyor 380 feet long, which takes the material to a large revolving screen, where sand, mud and fine gravel are washed out, passing down a sluice box fitted with riffles to catch the small amount of gold present. The coarse rock discharged by this trommel passes by conveyor to the crushing plant, where it undergoes successive stages of crushing and screening, producing various products which are finally distributed to different piles by a system of belt conveyors. A Brownhoist crane is used for loading railroad cars from the piles. Ample spur track facilities are supplied. connecting with the Placerville branch of the Southern Pacific Company. Electric power is used in the crushing plant.

When full handed, the plant employs 50 men and has a capacity of

2400 tons a day. The following products are sold:

Screenings (dust to three-eights inch).

Crushed rock in three sizes: Three-fourths inch, $1\frac{1}{2}$ inches and $2\frac{1}{2}$ inches.

Washed gravel in three sizes: Three-eighths inch, $1\frac{3}{8}$ inches and $1\frac{1}{2}$ inches.

Approximately 100 acres have been worked off and several hundred acres more remain.

This is an example of a plant marketing the waste from a mining operation where the profits per yard from the waste probably exceed those from the original gold dredging.

Bibl: State Mineralogist's Report XV, pp. 413-415.

Pratt Building Material Company. C. F. Pratt, president. Main office, 518 Hearst Building, San Francisco. The sand plant is on the south side of American River near the Twelfth street highway, just north of Sacramento city limits, M. M. Albee, superintendent of plant.

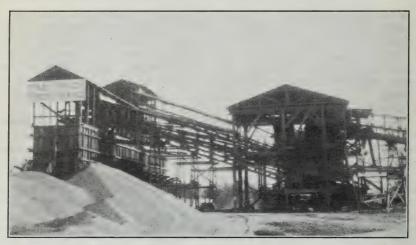
Sand is dredged from American River channel by a Sauerman dragline bucket, raised to the plant and washed, screened and stored in bins

above the spur track for sale.

The sand is used for brick mortar and plaster particularly, and to a less extent for concrete. Screen size ranges up to one-eighth inch. Sand is brought to the bucket by high water, and variations in the size of sand occur at different seasons due to changes in the volume of water.

The plant has a capacity of 125 carloads a month and when full-

handed employs eight men.



Plant of Pratt Rock and Gravel Company, at Prattrock, adjoining Folsom.

Pratt Rock and Gravel Company. C. F. Pratt, president. Main office, 518 Hearst Building, San Francisco. Plant is at Prattrock, adjoining Folsom, on Southern Pacific Company's Placerville branch, where the company owns 158 acres of dredged land covered by dredger tailing piles, estimated to contain 6,000,000 tons of rock. Jos. W. Pike,

superintendent of plant.

The rock is dug and loaded by a steam shovel, and hauled by steam locomotive in 4-yard cars three-fourths of a mile to the plant, where it is elevated by a 30-inch belt conveyor 415 feet long to the first trommel. Sand is washed out and passes over riffles in a sluice box. Gravel up to $1\frac{1}{2}$ inch in size is also screened here and goes by a belt conveyor to an outside stock pile. Sizes between 11 and 41 inches go by belt conveyor to the secondary crusher bins, and sizes over 41 inches go directly from the first screen to the primary crusher, a Worthington 36-inch by 24-inch jaw crusher. Product from this and from the secondary crusher bins is broken in two 6-inch Worthington Superior McCully crushers, from which it is raised by a bucket elevator to a second trommel, with 23-inch holes. Oversize is returned to the secondary crushers and undersize is taken by a belt conveyor to the top of the bin house, where it goes through a trommel 24 feet long which separates three sizes of product, which are stored in eight separate bins below, from which railroad cars are loaded, or in stock piles beside the railroad tracks. The plant has a capacity of 1000 to 1200 tons in eight hours and there are 26 men in a full crew.

The following products are made:

Screenings, size three-eighths inch to dust.

Crushed rock, three sizes, three-fourths inch, $1\frac{1}{2}$ inch and $2\frac{1}{2}$ inches.

Washed gravel, size one inch to 1½ inches.

A Brownhoist crane on railroad trucks is used for loading rock from stockpiles into railroad cars and for switching cars. The plant is served by a spur from the Southern Pacific Company's branch, and has 3800 feet of broad-gauge track besides its own narrow-gauge tracks.

Sacramento Mortar and Sand Company. Plant and office on south bank of American River at end of Twenty-fourth street, just north of

Sacramento city limits. Will Thomas, manager.

A 7-inch sand pump and 100-h.p. motor are installed on a barge which is anchored in the river and can be moved about as occasion requires. Sand is pumped to the top of the plant where it is screened and goes into a settling tank, where the clean, heavy sand settles to the bottom and is drawn off, agitation being sufficient to float off the clay. Sand is then raised by bucket elevator to the bunkers, which have a storage capacity of about 500 cubic yards. The plant has a capacity of 400 cubic yards in eight hours. Only two men are required to carry on the pumping and washing operations.

A mortar plant is just being built, and the company has recently purchased the rights for seven counties for the manufacture of concrete bricks under the Shope Patents. The installation of the patented machinery is planned for the near future. Sand dredged on the prop-

erty will be used with cement to make the bricks.

At present the sand is used principally for brick work, plaster and concrete in Sacramento and no spur track has been built, all deliveries being by truck.

MOLDING SAND.

The sandy loam forming the surface soil of part of the Sacramento Valley in and near Sacramento has been found suitable for molding sand for some purposes. This soil layer is variable in depth, but usually quite thin. It is fertile and easily worked, and as it is a valuable soil, in a district where land is rather high priced and a great many gardens are planted by city and suburban owners of lots and small acreage, there is a question as to whether it is not of greater ultimate value when thus used, rather than for molding sand, except where the underlying hardpan is to be used for clay.

Cannon & Company. Office: 400 Forum Building, Sacramento. Deposit is upon the company's property near their pottery (which see).

The turf is removed, and after plowing, the sandy loam is dug with a dragline scraper, which delivers to a belt conveyor and thence to dump bottom wagons in which the sand is hauled a short distance to a loading bin beside the railroad spur. Here the load is dumped into a pit, picked up by a small bucket elevator and loaded into railroad cars.

The dragline scraper, belt conveyor and electric motors are housed in a small portable building which can be moved around by a team of

horses.

The deposit of molding sand upon this property varies from less than a foot to three feet in thickness, and does not cover the entire acreage, but occurs in irregular shaped areas on the higher, rolling land. It is a medium-fine-grained reddish-brown sandy loam, consisting of angular sand grains and clay, free running when dry but slightly coherent

when wet. The underlying hardpan is used for clay products after the molding sand has been removed.

Three men are employed irregularly, depending on amount of sales.

PLATINUM GROUP METALS.

This subject was covered in considerable detail in Bulletin 85 of the State Mining Bureau, stock of which is now exhausted, and the following is summarized from it.

These metals occur in the gravel deposits along the ancient and modern courses of American River and its tributaries and along Cosumnes River, and have been recovered entirely as a by-product of the gold dredging operations.

Large areas of serpentine cross these watersheds in several belts, trending slightly west of north, across the counties east of Sacramento County. Chromite occurs frequently in these areas and was mined extensively during the war. Presumably the platinum group metals came from this serpentine or from the parent rock from which this serpentine was derived.

The average of five assays made upon lots of from thirty to eighty ounces each, showed 43.49% platinum and three of these showed 22.57%, 23.13% and 25.17% iridium. Osmium was not accounted for,

but probably averaged about 30%.

The record of platinum production from this county is incomplete prior to 1914. For a few years following 1914 it was about 200 ounces per annum, decreasing rapidly until at present it is about 100 ounces a year. The Senn Panning-Motion Batea formerly used to make the final recovery of platinum from the black sand concentrate has been replaced by a homemade centrifugal concentrator.

Bibl: State Mining Bureau Bull. 85, pp. 27-29.

REFRACTORY SAND.

Burns Property. T. M. Burns, 2207 N Street, Sacramento, owner and operator. Property is a mile southeast of Ben Ali, and some land

also just west of Ben Ali is being worked.

Sandy loam, slightly more clayey in places than similar loam used for molding sand, is dug by hand and horse scrapers, shovelled into wagons and hauled to railroad cars for shipment. This material is being used for refractory purposes, and the shipments are irregular depending on demand. The deposit is shallow and similar in occurrence to the molding sand mentioned elsewhere.

BIBLIOGRAPHY ON SACRAMENTO COUNTY.

Publications of California State Mining Bureau.

Report of State Mineralogist:

Eighth Report, pp. 556-557 (General).

Tenth Report, pp. 496-514 (Water resources, well logs, mineral resources).

Eleventh Report, pp. 334-336 (Water resources). Twelfth Report, pp. 225-227 (Gold placer mines).

Thirteenth Report, pp. 316-318 (Gold placer mines).

Fifteenth Report, pp. 400-418 (General, mineral resources).

Bull. 38, pp. 47, 48, 225-253 (Structural and industrial minerals).

Bull. 57, pp. 174-204 (Gold dredging). Bull. 85, pp. 27-29 (Gold dredging, platinum).

United States Geological Survey Publications:

Folio 3, 5, 11. Reprint (Areal and economic geology). Prof. Paper 73 (Auriferous gravels).

Water Supply Papers, 298 and 375a.

SAN FRANCISCO FIELD DIVISION.

C. McK. LAIZURE, Mining Engineer.

MONTEREY COUNTY.

Introduction.

Few, if any, counties of the state have a more interesting early history

than that of Monterey.

The settlement of the Monterey peninsula began with the establishment of a mission and presidio at Monterey in 1770, although the bay was entered and explored by Visaino 168 years previously, in 1602, and it had been discovered and named still earlier by Cabrillo.

Comprised of rich valleys, interspersed between the Santa Lucia, the Diablo, the Gavilan and lesser spurs of the Coast Range, and with a rugged coast line of unsurpassed beauty, Monterey County has been

from the earliest period a mecca for travelers.

The more fertile valley lands and much of the mountainous portions, originally included in Spanish 'grant' lands, are held as large 'ranchos.' There still remain individual ranches of 35,000 to 40,000 acres each, and this condition has not been conducive to full and intensive development of the county's resources, either along agricultural or mining lines.

The principal industries are agriculture, stock-raising, and dairying. The mining industry and the commercial fisheries are also of importance. The mining industry is relatively undeveloped, although the

mineral resources of the county are varied and extensive.

There is an old shaft on the Alisal Rancho, a few miles east of Salinas, sunk more than 100 years ago, in which ore was found containing gold, silver, lead, and copper values. Despite such early beginning, the precious metals have been found in important quantities in only one district within the county, and it is to the enormous deposits of the more common structural and industrial materials and fuels, that the mining industry must look for its greatest returns.

Most of such deposits are found on land that long ago passed into private ownership. As such deposits can not be 'located,' there is little inducement for the prospector, and their development by the owners, whose interests have been confined to other lines, has been neglected.

The continued growth of manufacturing industries on the Pacific coast, however, has created a growing market for these products, and an era of increased development and production is apparently at hand.

It is the purpose of this report to bring together data pertaining to the minerals of the county, so far as they have been investigated by the State Mining Bureau, in the hope that their development and utilization may be hastened.

DESCRIPTION.

Geography.

Monterey is one of the central coast counties, extending from the Pajaro River, which empties into Monterey Bay, south to the sixth Standard Parallel. It is bounded on the north by Santa Cruz County. San Benito, Fresno and Kings counties adjoin it on the east, and San Luis Obispo County bounds it on the south. Its area is 3330 square miles and its population 27,980 (census of 1920). The main line of the

Southern Pacific railroad, coast division, runs through the county, connecting it with San Francisco and Los Angeles, as also does the state highway, a concrete paved road. Connecting county roads are kept in good condition, and it is only in the more remote mountainous sections that economic transportation becomes a problem. The completion of the proposed road along the coast, connecting Monterey and San Luis Obispo, now open from the north to a point 18 miles beyond Big Sur and from the southern end as far north as Salmon Creek, will open up a large area which has heretofore been accessible only by water or steep trails, and one whose mineral resources are scarcely known.

Topography.

Among the principal topographic features is the great central Salinas Valley, the largest of the intermountain valleys of the coast region; being about 100 miles long by 6 to 10 miles in width, and lying parallel to the coast. Between the valley and the coast rises the Santa Lucia Mountain Range which culminates in a number of peaks, some reaching nearly 6000 feet above sea-level. Along the eastern side of the valley, and with their crests forming the eastern boundary of the county, are the Gavilan and Diablo Ranges. Among the smaller valleys are the San Lorenzo, San Antonio, Cholame, Carmel, and Nacimiento. In each of these the principal axis extends northwesterly, parallel with the general structure of the mountain ranges.

Geology.

The geology of most of Monterey County is described and mapped in Bulletin No. 69, of the State Mining Bureau, 'Petroleum Resources of California,' and the folio accompanying it. It is also shown in lesser

detail on the Geological Map of California (1916).

The Santa Lucia Range has a core of granitic rock. This is exposed in Santa Lucia Peak at an elevation of 5967 feet, and throughout the territory between Carmel River and Sur River, either along the coast or in the river cuts. Limestone and gneiss overlie the granite in places, and make up Pico Blanco, Ventana Cone, Marble Peak, Twin Peak, and Cone Peak. Most of the area from Mill Creek southward to Three Peaks and bounded on the northeast by Nacimiento River, is made up of Franciscan sandstone and shale, with intrusions of serpentine. It is in the region of these serpentine intrusions and the later intrusive acid dikes that the important mineral deposits of the Los Burros district are found. The geology of the Los Burros district has been described in considerable detail by Hill. There is evidence throughout of much faulting, and the precipitous coast follows a fault line. Monterey sandstone and conglomerate flank the mountains on the southwest side of Nacimiento River, and dip towards the valley. Most of the older sediments exposed east of the Nacimiento consist of Monterey shale, which is considerably folded east of Jolon.

Along the coast, resting unconformably on the granite and Franciscan rocks, are raised beach deposits. The settlment of Gorda is located on the more recent of these terraces. This terrace is noticeable in Willow Creek, one-half mile back from its mouth, and also along the coast north of Gorda. These terraces are important in relation to placer

¹ Hill, J. M., The Los Burros District, Monterey County, California. U. S. Geol. Survey Bull. No. 735-J, 1923.

gold. It is thought that the placer deposits near Jolon originated in a similar manner.

In the northeastern part of the county, in the Gavilan Range, granite occurs associated with gneisses and schists. In places these rocks contact with massive beds of metamorphosed limestone, and dolomite is commonly associated. Feldspathic segregations give rise to commercial deposits of feldspar along the range as far south as the Pinnacles. In the vicinity of the Pinnacles there is a small area where volcanic activity has taken place and extrusive volcanic rocks are in evidence. Farther south Tertiary sandstone and shales predominate. A long narrow belt of the Franciscan rocks, including slates, sandstones, and much schist and serpentine, extends from Priests Valley southeastward beyond Parkfield. Workable coal beds are exposed in the vicinity of Priests Valley and the principal quicksilver deposits occur in the Franciscan, not far from Parkfield.

MINERAL RESOURCES.

The last general report on the mines and mineral resources of Monterey County appeared in the Fifteenth Report of the State Mineralogist (1915–1916). Bulletin No. 78, 'Quicksilver Resources of California' (1918), describes the quicksilver mines in detail. A few additional notes on mining activities appear in the Seventeenth Report of the State Mineralogist (1920). The petroleum possibilities are discussed in Bulletin No. 89, 'Petroleum Resources of California' (1921).

The first ten days of January, 1925, were spent by the writer in a survey of the county in an endeavor to collect up-to-date data on all the mining activities and mineral resources. The Los Burros district was not visited; but, as there is a report of the U. S. Geological Survey, of recent date, on this district,² it was thought advisable, on account of the limited time available for field work, to spend it in areas more easily reached. Appreciation is here expressed for the courteous treatment and cooperation of operators, owners and chambers of commerce

throughout the county.

The following commercial minerals are of record as occurring in Monterey County: Arsenopyrite, barite, bitumen (asphaltum), calcite (limestone and marble), chromite, cinnabar (quicksilver), clay, coal, copper, diatomaceous earth, dolomite, galena, garnet, gold, graphite, gypsum, magnesite, magnetite, malachite, metacinnabarite, molybdenite, orthoclase (feldspar), psilomelane (manganese), quartz, salt, serpentine (asbestos), and stibnite. Not all of these have been produced in commercial quantities, however, nor is it known that all occur in sufficient quantity to be of value. About ten other mineral species of mineralogical interest only have also been noted.

The following table gives the complete recorded output and value of the mineral production of the county from the earliest available

record, 1889, to and including 1923:

² Hill, J. M., op. cit.

MONTEREY

Year Gold,		Silver, Brick			Diatomac	eous earth	L	ime	Limestone	
	value	value	M.	Value	Tons	Value	Barrels	Value	Tons	Value
889	\$3,500									
890	11,815									
891	3,000									
892	0,000									
893										
894	8,000									
895										
896										
897									2,000	\$2,00
898			400	\$2,400					2,049	1,64
899			200	1,400					7,744	6,97
900			200	1,600					8,000	10,80
901	13,800								5,463	7,50
902	6,860	\$18					22,000	\$13,200		
903	8,920						26,000	23,400	6,516	9,00
904	6,941		200	1,600			3,240	3,240	4,550	21,50
905	4,000						10,000	10,000		
906	625	3			80	\$400	40,000	50,000		
907	1.076	9	426	0.000			100,000	125,000 50,900		
909	1,318	9 5	300	3,838	500	3,500	50,000		10 650	45,67
1909	333	J	300	2,900	300	3,300	50,006	62,507	10,658	40,07
910	21,013	10	993	9,957	500	3,500	30,894	29,349	2,500	7,50
911					850	5,950			2,000	6,00
912	37,647	67							6,000	8 00
913	6,491	27			1,700	6,800			6,500	13,00
14 19	4,000	20								
1915					4					
.916					4					
917					4				4	
1911					,					
0.4.0										
918					4					
1919					4					
920					4					
921					4					
922										
000										
923										
Totals	\$89,339	\$168	2,719	\$23,695	43,630	\$20,150	332,140	\$366,696	463,980	\$139,58

¹Includes crushed rock, rubble, sand, gravel.

²Includes Monterey, San Luis Obispo and Santa Cruz counties.

⁴Includes Los Angeles and San Luis Obispo counties.

⁴See under 'Unapportioned.'

⁴Includes molding, building, blast, filter, roofing sand.

COUNTY, 1889-1923.

Mineral water Glass sand		sand	Miscel- laneous	Miscellaneous and unapportioned				
Gallons	Value	Tons	Value	stone ¹ , value	Amount	Value	Substance	
				\$1,500				
5,000	\$1,000							
2,000	200							
21,000	1,050			14,025				
1,500	750			8,258 2,775				
20,000 15,000	4,000	4.500	\$15,750	2,775 8,869	200 tons	\$1,000	Coal.	
15,000	3,250 1,750	4,500	12,225	5,200	200 tons	\$1,000	Coal.	
55,000	1,250	5,989	4.967	3,167	61 tons	732	Asphaltum.	
25,000	1,000	8,295	7,272		124 tons	1,488	Asphaltum.	
5,000	1,000	9,257	8,127					
24,000 120,000	12,000 12,000	750 11,065	1,125 8,178		4,800 tons	24,000	Coal.	
120,000	12,000	6,805	5,120	31,727	7 flasks	296	Quicksilver.	
10,000	2,000	6,496	4,872	43,351	∫ 1 flask	49	Quicksilver.	
					}	344,789	Unapportioned, 1900-1909.	
		7.594	5,890	47,487	7 flasks	317 5,000	Quicksilver. Feldspar.	
		1,00%	3,000	41,401	200 tons	2,500	Fuller's earth.	
				27,011	11,000 tons	4,950	Clay.	
20,000	7,000	9,016	7,916	60,119	4,000 tons	6,000	Clay.	
00.000	7,000	0.141	0.100	10 550	320 tons	3,200	Coal.	
20,000	7,000	9,141	9,192	12,556	35,000 tons	78,332 12,000	Other minerals.	
					300 tons	2,700	Clay. Fuller's earth.	
					5,992 tons	2,700 17,976	Coal.	
26,000	7,900	9,210	7,633	39,202		9,450	Other minerals.	
					700 tons	3,500	Feldspar. Fuller's earth.	
					450 tons	3,150 50,137	Coal, feldspar, diatomaceous eart	
8,200	2,050	4		32,799		00,101	quicksilver, silica.	
5,900	590			58,623		50,659	Barytes, feldspar, diatomaceous eart	
					(0000)	00.400	quicksilver, salt, silica.	
		4		57,810	6,392 tons	23,468 57,508	Dolomite. Barytes, diatomaceous earth, lim	
		The state of the s		31,010)	31,300	stone, mineral water, quicksilve	
					,		salt, silica.	
				WO 005	(4,900 tons	25,950	Dolomite.	
		4		52,697	{ 700 tons	3,800	Feldspar.	
					(37,240	Barytes, coal, diatomaceous eart quicksilver, salt, silica.	
		4		73,031	8.280 tons	29,120	Dolomite.	
					1	43,353	Barytes, coal, feldspar, diatomaceo	
000	60			504.070	/ # 777 4-	00 000	earth, salt silica.	
200	20	1		584,056	5,755 tons	26,238 16,135	Dolomite. Barytes, coal, feldspar, diatomaceo	
					(10,100	earth, salt, silica (glass sand).	
		4		663,316	§ 2,500 tons	8,750	Dolomite.	
					1	98,089	Asbestos, coal, diatomaceous eart	
		4		100 100		160 190	mineral water, salt, glass sand.	
		4		٤86,180		169,139	Asbestos, coal, dolomite, quick- silver, salt, glass sand.	
		4		5140,724		81,298	Asbestos, diatomaceous earth dol	
				.,		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	mite, mineral water, quicksilve	
							salt, glass sand.	
4398,800	\$65,810	492,618	\$98,261	\$954,483		\$1,243,313		
000,000	000,010	92,010	000,401	602,2000	1	W1,210,010		

ARSENIC.

Riley Ranch Deposit. The Riley ranch comprises about 1600 acres situated 12 miles east of Chualar at the head of Chualar Canvon, and takes in the summit of the Gavilan Range. J. F. and J. T. Riley, owners, Box 424, Salinas, California. The summit of the ridge on this property is made up of heavy limestone beds which have here been intruded by deep-seated igneous rocks. Along the irregular contact of these formations there is a mineralized zone showing arsenopyrite, magnetite, limonite, azurite, and malachite. An open cut and short tunnel at one point developed a fair showing of arsenopyrite which would probably have some value as an ore of arsenic if the price of arsenic again reaches the high point it did a year or so ago. More or less magnetite and limonite are associated with the arsenopyrite. Several hundred yards from this point a shaft has been sunk about 30 feet on an iron-stained outcropping showing oxidized copper minerals. Material from the bottom of the shaft is said to carry values in gold and silver, as well as copper. The deposit was opened up in 1923. No work is being done at present.

ASBESTOS.

Burro Asbestos Mine. Walter R. Harris, of Bryson, Monterey County, and J. E. Barrett, 903 Sandercock St., San Luis Obispo, the owners of this deposit, opened it up in 1920, and have continued development by means of open cuts and tunnels. The deposit is located about 30 miles southwest of King City. There is a good auto road to Bryson and then 4 miles of trail. The property comprises 7 claims and covers an area of serpentine containing veins of chrysotile asbestos with fiber up to 1½ inches in length and of good quality. The deposit has a width of about 300 feet and it has been traced over a length of three claims. With the exception of small lots shipped to the U. S. Asbestos Co., Downey, California, and other consumers for testing and trial, there has been no commercial production.

ASPHALTUM.

Deposits of asphaltum occur in three districts in Monterey County. In the region southwest of Bradley, near the Nacimiento River, sandstone impregnated with oil is exposed and has been quarried for use on the roads and bridges about King City.

East of Parkfield at the foot of Table Mountain and on the west side of Little Cholame Creek oil-impregnated rocks are exposed which

have been a stimulus to oil prospecting.

Another asphalt quarry two miles west of Lonoak could still furnish considerable road material but it has not been worked for many years.

Bibl: State Mineralogist's Report XVIII, p. 229; Bull. No. 69, Petroleum Industry of California, pp. 418–438; U. S. Geol. Survey 22d Annual Report, pp. 379–452.

BARITE.

Operations have ceased at the deposit of barite on Fremont Peak. Barite was formerly produced here by A. R. Haskins, of Hollister, under a lease from the owners, J. and H. Bardin, Salinas, California. It is reported worked out.

Bibl: State Mineralogist's Report XVII, p. 156.

CHROMITE.

Detached masses of chromite are found in the serpentine on Table Mountain near Parkfield. None has yet been produced commercially.

CLAY.

There has been no recent production of clay reported from the county. A clay pit and brickyard were at one time operated at the south end of Salinas, near the cemetery, and several thousand tons of clay have come from a deposit owned by J. C. Jens, 636 W. Adams St., Los Angeles, situated east of Chualar.

Bibl: Preliminary Report No. 7, 'Clay Industry in California,' p. 65.

Echstine Deposit. A deposit of white plastic clay is reported to occur in T. 24 S., R. 8 E., on the property of Mrs. G. P. Echstine, of Pleyto, California. The deposit has not been investigated as yet, and its commercial value is unknown.

Heins Lake Deposit. Owner, Martha E. Bardin, Salinas, California. The bottom of Heins Lake, now dry, situated about 2 miles southeast of Salinas, is composed of blue clay. There is about 300 acres in the deposit, and it is said to average 4 feet in depth.

COAL

The coal deposits in Monterey County are one of its chief mineral resources. The greater part of the coal output of the state during the past few years has come from this county, from the Stone Canyon Coal Mine. This mine ranks as the most developed and best equipped coal property in the state. Stone Canyon coal has been classed as a bituminous variety.¹

As much of the coal in California is lignite, or of such low grade that it cannot be used to advantage as a steam coal, investigations have been under way in various quarters looking to a more economical method of utilizing the deposits. Research has taken the form of its possible utilization in the direct production of sponge iron and steel in the electric furnace. Others have investigated the low-temperature distillation process with the production of a semi-coke briquette, said to be an ideal smokeless domestic fuel, and various by-products. Experiments which give promise of success have been made to purify lignites and low-grade coals by some process such as the Trent method, which consists in agitating together powdered coal, water and oil. This produces a partly de-ashed plastic fuel called 'amalgam,' the oil selecting the coal particles and largely excluding the water and ash. In one experiment on a California lignite, the ash reduction amounted to 26.8%, the combustible recovery was 95%, and the sulphur reduction was 12% after treatment. Others have considered the manufacture of calcium carbide (CaC₂) from lime and lignite coal. Still other investigators have undertaken to show how these coals may be utilized in powdered form, either alone or with oil in 'collodial' fuels; to make them into briquettes without the use of an expensive binder; to manufacture producers gas from them; and to obtain for commercial use their other constituents, including ammonia, benzol, toluol, solvents, drugs, oils, and other coal tar

¹ Campbell, M. R., U. S. Geol. Survey Bull. 316, p. 435.

products. All of these avenues offer possibilities which will doubtless attract the attention of capital before many years, and the coal deposits in Monterey County cannot fail to receive their share of attention.

Bibl: Coal Resources of Monterey County. State Mineralogist's Reports VI, p. 117; VII, pp. 172, 178; VIII, p. 403; X, p. 347; XI, p. 259; XII, p. 59; XIII, p. 54; XV, p. 597; XVII, p. 156; XVIII, pp. 152-157; XIX, p. 26. Preliminary Report No. 8, pp. 9-10. U. S. Geol. Survey, Bull. 295, p. 223; 316, pp. 435-438; 431, p. 243; 521-d, p. 158; 585, p. 29. U. S. Geol. Survey Mineral Resources, 1909, p. 102. U. S. Bureau of Mines Bull. 22, pp. 53, 396; Bull. 38, p. 37. Univ. of California, Dept of Geology, Vol. I, p. 22.

Carmel Coal Mines. Situated about 14 miles south of Monterey and 2 miles from the coast at an elevation of 1000 feet. This property



Typical Outcrop, Priests Valley coal field.

was a producer at one time, a tram way having been built from the mine to the beach. There was a double compartment shaft 275 feet deep, an incline and drifts. Three veins, 2, 4 and 6 feet thick, respectively were reported. Idle for many years. Owner, A. M. Allen, care Monterey Canning Co. Monterey, California.

Bibl: S t a t e Mineralogist's Reports VIII, p. 404; X, p. 347; XII, p. 54.

Monterey Coal Co. A company by this name did considerable prospecting at one time on a bed of lignite in Priests Valley. A typical outcrop in the Priests Valley field is shown in the accompanying photo.

> Bibl: Priests Valley. State Mineralogist's Reports VIII, p. 404; XII, pp. 59-60. U. S. Geol. Survey Bull. 581-d, pp. 158-160.

Stone Canyon Coal Mine. This property, which has had a somewhat interesting history since its discovery about 1870, is situated near the center of Sec. 14, T. 22 S., R. 13 E., M. D. M., at an elevation of 2748 feet.

After intermittent work by various operators, the mine was equipped at great expense and opened up on a large scale a short time previous to 1914 by the Stone Canyon Consolidated Coal Co., the product being shipped out by rail over a 21-mile spur track built from the mine to McKay, a station on the Southern Pacific Railroad, three miles north of San Miguel.

Heavy floods in January, 1914, washed out the railroad and destroyed the bridge over the Salinas River. This disaster, coming just at the

time they expected to realize some returns on the investment, caused the mine to close down, and no effort was made to resume operations on

a large scale.

In July, 1921, it was reported that the mine had been sold to eastern capitalists for \$1,500,000. Work was commenced on the mine and railroad in the latter part of 1921, by a company headed by Mr. John H. Leavell. By September, 75 men were employed, and during the first half of 1922, there were 60 men working on top and about the same number underground. Operations continued during 1922 until after the middle of the year, the output being about 200 tons per day. It was reported that the coal had to be rehandled many times between the working face and the railroad cars, that mining costs were excessive, and that the mine could not be profitably operated unless at least 500 tons per day was produced. The output could not be raised to that figure, and the mine was again shut down.

In February, 1924, the Cal-Coal and Iron Co. was organized with an authorized capital of \$3,500,000, for the purpose of purchasing and operating the Stone Canyon properties. A permit to sell \$2,700,500 shares at par for this purpose was issued by the State Corporation Department. This effort to finance the property by popular stock subscription proved unsuccessful, however, and the attempt was given up. As a result, the property reverted to and remains under the ownership and control of the Stone Canyon Coal Co. and J. A. Chanslor, 509 Wells Fargo Bldg., 85 Second St., San Francisco. It comprises 2330 acres of patented land, 4600 acres under contract of purchase from the state; all equipment, together with 21½ miles of broad gauge railroad, and right of way and 14 acres of land at McKay Station. Reports filed with the Commissioner of Corporations place the amount of coal in sight at 3,899,000 tons, 80% recoverable; and a probable additional tonnage of 10,000,000 tons, of which 60% is regarded as recoverable. Not producing at present.

Bibl: State Mineralogist's Reports VII, p. 172; VIII, p. 403; XII, p. 59; XIII, p. 54; XV, p. 597; XVII, p. 156; XIX, p. 26. Preliminary Report No. 8, p. 9. U. S. Geol. Survey Bulls. 285, p. 223; 316, pp. 435-438; 431, p. 243; 581, p. 158. U. S. Geol. Survey Mineral Resources, 1909, p. 102. U. S. Bureau of Mines Bull, 22, pp. 53,396; Bull. 38, p. 37.

COPPER.

No copper deposits of importance have been developed in Monterey County, although native copper, malachite, chalcopyrite, and other copper minerals have been noted in minor amounts at a few localities.

Copper occurs as malachite in serpentine in Sec. 21, T. 23 S., R. 15 E., east of Parkfield. L. E. Bedell, of Parkfield, located some claims here, but nothing has ever been done with them.

Bibl: State Mineralogist's Report XV, p. 598.

Hammond Claims (see under Gold).

Native Copper Co., of Coalinga, at one time had a group of claims in Sec. 26, T. 23 S., R. 15 E., 7 miles east of Parkfield. Native copper was found there in serpentine. Nothing has been done recently, and they are probably abandoned.

Bibl: State Mineralogist's Report XV, p. 598.

Riley Ranch Deposit (see under Arsenic).

DIATOMACEOUS EARTH.

A belt of diatomaceous earth runs along the eastern foothills of the Santa Lucia Range from the southern boundary of the county in T. 24 S., R. 10 E., in a northwesterly direction to Arroyo Seco in T. 19 S., R. 6 E. It shows again in Secs. 26 and 36, T. 15 S., R. 2 E. Most of the development has been in the area west of Bradley.

California Kieselguhr Co., Inc. Officers, John W. Work, president; W. I. Davis, vice president; Geo. C. Langley, secretary; F. B. Pendry, treasurer. Home office, San Miguel, California. The property of this company comprises 340 acres in Monterey County in Secs. 14 and 15, T. 24 S., R. 10 E., on the west side of the road between Bradley and Jolon. The surface is composed of fairly rugged hills, bare of timber, cut by a number of narrow canyons. Elevation at the principal workings, 1100 feet. Diatomaceous earth is exposed on about 75% of the area. The deposit was opened up in May, 1922, and the plant in San Miguel was started about six months later. It is 14 miles from the deposit to the mill. The crude earth is transported by motor truck and trailer in 10-ton lots, most of the haul being over the state highway with a good road from the deposit to the highway.

The deposit is being mined by both open cut, using pick and shovel, and by means of tunnels, drifts and stoping of the bed, which dips about 30°. There are 7 tunnels of varying length up to 150 feet. Low-grade material is mined in the open cuts, and high-grade by selection and underground stoping. Light shots are occasionally used in the stopes. By following this method it is possible for the company

to produce a uniform high-grade earth when demanded.



Open cut and loading bin, in Middle Canyon. California Keiselguhr Co., Inc., San Miguel, California.

Material from this deposit carries much less moisture than is usually found, and no artificial drying is required, it being possible to mine, mill, sack, and ship the earth within 8 hours.

The grinding plant is situated on the main line of the Southern Pacific Railroad in San Miguel, with a side track running through the center of the mill building. The crude earth is dumped from the trucks to bins and passes from the bins by a belt conveyor to a Williams hammer mill of 5-ton per hour capacity at 2100 r.p.m., driven by a 100-h.p. motor. A 45-inch Sturdevant fan draws off the discharge, which goes through a pipe, with traps for the heavier material, to a cyclone collector. The discharge from the first cyclone passes to a second cyclone, and then to the bag house for sacking and storage. The maximum capacity of the plant is 6 tons per hour. Operations have been intermittent, depending on demand. From 7 to 10 men are employed when operating.



Treatment plant of California Keiselguhr Co., Inc., at San Miguel, California.

Jens Deposit. Owned by J. C. Jens, 636 W. Adams St., Los Angeles. This deposit is on 120 acres of patented land in Sec. 20, T. 23 N., R 10 E., about 6 miles northwest of Bradley. Formerly operated by J. C. Jens, under the name of the Mineral Earths Supply Co. There has been no production the last two years.

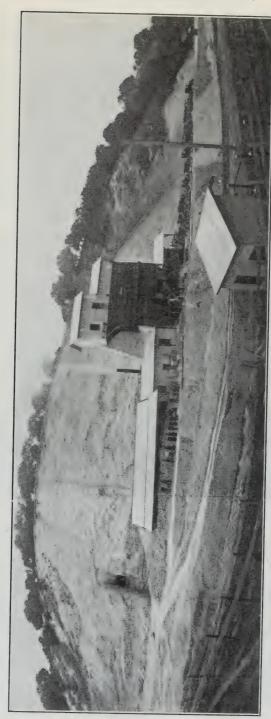
Bibl: Report of the State Mineralogist, XV, p. 598.

Monterey Products Co. Incorporated October 4, 1923. C. A. Ryan, president; W. V. Buckner, vice president; T. Lee, secretary-treasurer. Office, Suite 37, Work Building, Monterey, California.

This company and its subsidiary, the Monterey Insulated Brick Co., Inc., with the same officers, controls 3900 acres under a 50-year lease,

of which 100 acres cover a deposit of diatomaceous earth.

The deposit is a part of the old Saucito Rancho Grant, owned by T. A. Work. It is situated on the Salinas-Monterey highway four and one-half miles from Monterey. Shipments from Monterey can be made by either rail or water,



Monterey Products Company's Plant No. 1.

The exact extent of the deposit has not been definitely determined but it has been shown to extend over a considerable area. It is believed to have an average depth of 300 feet of soft diatomaceous earth and is roughly estimated to contain from 7 to 10 million tons. The material so far exposed is very pure. It is of marine or salt water origin, and is said to contain a large percentage of unbroken diatoms. The surface consists of rolling hills, partly covered with live oak. The elevation at the plant site is 160' above sea level. Water is obtained from springs.

At the point where mining operations were begun there is no overburden, but in other places the diatomaceous earth is covered or partly covered by other formations. Mining is by the open-cut method in benches with pick and shovel. The material, as mined, is passed down a chute to the mill by gravity. The mill building and warehouse are of corrugated iron over a wooden frame, set on concrete foundations. Electric power, furnished by the Pacific Gas and Electric Co., is used

throughout, there being a substation on the property.

At the bottom of the chute from the working face, the material is fed to a conveyer belt, which carries it to toothed rolls. From the rolls it is taken by bucket elevator to an oil-fired revolving drver. A suction fan draws off the steam and air from the dryer, and this pipe is arranged so that the discharge may be passed through one or more, up to eight, cyclone separators, where the fine material carried over is collected. The coarse material from the drver is elevated to two bins, each 20 feet square and 30 feet deep. From these bins the dried earth goes to a K-B hammer mill for pulverizing. An air blast picks up the discharge from the hammer mill and blows it through a pipe to a single long settling bin, the coarser material settling out first and the finer farthest from the pipe discharge. Excess air from this bin, carrying a very fine product, is passed through another cyclone where the very finest material is collected. Sacking devices are located at intervals under the long bin so that any grade desired may be sacked. After being placed in bags, the material is stored in the warehouse, which has a capacity of 20 cars of finished product. The capacity of the plant is 30 tons in 8 hours. The Monterey Products Company's output is sold under the trade name of 'Calatom' and is used for filtration purposes in the manufacture and refining of sugar, yeast, oils, and lard. It is used also in the making of dynamite, as a soap filler, as insulation in bake-ovens and boilers and in polishes.

Oakdale Ranch Deposit. This property, comprising 200 acres, is known as the Oakdale Ranch, address A. B. Ford, Pleyto, California, or C. D. Ford, 480 Twenty-fourth Street, Ogden, Utah, owners. It is situated in Sec. 18, T. 24 S., R. 9 E., M. D. M., about 2 miles from Pleyto on the Pleyto-Bryson Road, and 20 miles by good road from Bradley, the nearest railroad shipping point. Copperhead Canyon Creek furnishes a water supply the year round. Cream-colorerd diatomaceous earth of apparent high grade is exposed on the top and sides

of 4 hills covering an area of 20 to 40 acres. There has been no work done except to take a few samples. An analysis follows:

Moisture (105° C.) 7	.06%
Analysis of moisture free sample.	Per cent
Silica SiO ₂	83.61
Alumina Al ₂ O ₃	4.70
Iron oxide Fe ₂ O ₃	1.19
Calcium CaO	1.43
Magnesia MgO	
Soda and potash oxides R ₂ O	1.45
Titanium oxide TiO ₂	12
Manganese oxide	Trace
Sulphuric anhydride SO ₃	None
Phosphoric anhydride P ₂ O ₅	Trace
Sodium chloride NaCl	1.42
Combined waters and volatiles	5.81
Total	99.90
Analysis by Smith Emery & Co., San Francisco),

Pacific Diatom Products Co. Charles H. Pugh, Clarence A. Hunt, and Wm. H. Barker, of Berkeley, California, and Messrs. Poole and Clements, of San Miguel, California, directors. This company has a lease on the N½ of the SE¼ and the S½ of the NE¼ of Sec. 15, T. 24 S., R. 10 E., M. D. M., from the California Kieselguhr Co. on the F. Buttle property. They have contracted for 200,000 tons of diatomaceous earth in place, from the California Kieselguhr Co. on a royalty basis; the lessee to mine it. The Pacific Diatom Products Co. have erected a plant building in San Miguel, but the machinery has not as yet been installed and production has not begun.

Riewerts Deposit. This deposit is owned by B. J. Riewerts, 460 Jean street, Oakland, California. It is situated in Sec. 4, T. 24 S., R. 10 E. Intermittent shipments have been made since 1904. In 1923 it was under lease to W. C. Seccombe, 1120 Arrowhead avenue, San Bernardino, California, who made a small production.

Bibl: Cal. State Mining Bureau Bull. 38 p. 292.

DOLOMITE.

In a belt along the base of the foothills of the Gavilan Range near Natividad large deposits of dolomite have been developed. The belt crosses private ranches of various ownerships, and has been quarried at a number of points by different individuals. Operations have been carried on from time to time by H. Bardin, C. Z. Hebert, C. Patton, Robert Porter, Edward A. Taylor, and J. Braida, of Salinas. The most recent shipments have been made by O. D. Eastwood, from the Hebert property.

Webb and Mingus Deposit. E. A. Webb and S. M. Mingus, of Coalinga, own 160 acres in Sec. 28, T. 24 S., R. 16 E., containing a deposit of dolomite. It is about 8 miles east of Cholame. There has been no production.

FELDSPAR.

Jens Quarry. The deposit is on patented land owned by J. C. Jens, 636 W. Adams St., Los Angeles, in Sec. 34, T. 15 S., R. 5 E., about 5 miles east of Chualar. The haul is about 8 or 9 miles however, by way

of the road up Chualar Canyon, from the deposit to the railroad. A large amount of high-grade feldspar has been shipped from this deposit in the past, but it has been nonproductive for a number of years.

Bibl: Report of the State Mineralogist, XV, p. 601; XVII, p. 156.

Johnson Bros. Deposit. Orthoclase feldspar is found on the ranch of Johnson Bros., Chualar, California. The deposit is located in Chualar Canyon, 5 miles east of Chualar and about one-half mile from the Jens deposit. Samples from the surface cropping show some iron oxide present. No work has been done on it, but it is probable that a good commercial grade of feldspar can be developed here.

GARNET.

A sample of massive garnet has been sent to the Bureau Laboratory by D. Smith, Chestnut street, Salinas, California. Garnets are common in the sands of the Los Burros district, and they have been noted at other localities, but the occurrence of a massive variety has not heretofore been recorded. It would be suitable for the manufacture of abrasives.

GOLD.

LOS BURROS DISTRICT.

The Los Burros Mining District is in the extreme southwestern part of Monterey County in T. 23 and 24 S., R. 5 E., M. D. M. It is best reached from the railroad at King City, by stage to Jolon and

The first work in the district was in 1887 when W. D. Cruikshank discovered a small quartz vein carrying free gold. The discovery led to the development, on a considerable scale, of the Last Chance Mine, now owned by the Buclimo Mining Company. The property has been worked intermittently ever since.

Discoveries of placer gold in 1902 were made on Willow and Dogvine creeks and the Gorda and Plaskett mines were started. Placer work extended to all the nearby ravines.

From the years 1888 to 1915, inclusive, the district is estimated to have produced over \$150,000 in gold.

Bibl: State Mineralogist's Reports VIII, pp. 405-410; XI, pp. 259-262; XII, p. 184; XIII, p. 234; XV, pp. 602-605; U. S. Geol. Survey Bull. 735, pp. 323-329; Mining and Scientific Press, Vol. 104, pp. 696-698, 1 fig., May 18, 1912.

GEOLOGY.

The following notes on the geology of the Los Burros district are quoted from the report of J. M. Hill¹.

"The whole district is underlain by rocks of the Franciscan formation. No intrusive rocks other than the serpentinized basic dikes so characteristically associated with the Franciscan were noted, though intrusive granite occurs in the mountains at the headwaters of Nacimiento River. No attempt was made to map the irregularly distributed masses of serpentine, but there appear to be two more or less continuous belts or dikes, lying about 2000 feet apart and trending in a west-northwest direction, which run through the south-central part of the district. The most conspicuous exposures of the southern belt were noted along Spruce Creek, in the vicinity of the Gorda mine, and at the head of Alder Creek, near the Buclimo camp. The northern belt is well exposed along the south wall of the canyon of the South Fork of Willow Creek. The serpentinized rocks are almost completely altered, but a few specimens taken from the center of a particularly large outcrop indicate that the original rock was a peridotite.

¹ Hill, J. M., The Los Burros District, Monterey County, California, U. S. Geol, Survey Bull. 735-J, 1923,

"The Franciscan formation as exposed here is made up of dark greenish-gray arkosic, micaceous sandstones, in general fine-grained but passing into fine conglomerates that are usually noted as lenses rather than as continuous beds. Although sandstone predominates, a large amount of the rock weathers like shale, because of the fineness of the constituent grains and the parallel distribution of the mica. The most abundant constituent of the sandstone is quartz, but orthoclase and plagioclase feldspar is only slightly less abundant. The dark color of the rocks is due to the unusual amount of hornblende and biotite. Near the serpentine areas the sandstone is altered to contorted schist, much crushed and sheared and cut by veinlets of quartz and calcite. In places in the vicinity of the basic dikes considerable bodies of massive sandstone have been thoroughly impregnated with minute crystals of garnet and pyrite.

the rocks weather rusty brown, but there is a noticeable difference between

"All the rocks weather rusty brown, but there is a noticeable difference between the colors developed by weathering of the rocks in the deeper canyons and those near the summits of the ridges. The sandstone is massive, with little evidence of bedding, but weathers rapidly in small angular pieces that disintegrate readily into a brown sandy clay. The conglomerate lenses are usually composed of small rounded or egg-shaped pebbles of pinkish feldspar, white quartz, and black slate. In a few places, however, lenses of coarse arkosic sandstone, with small, flat, angular pieces of black slate, were noted. Only one small lens of radiolarian chert was seen; this lies at the head of Alder Creek a short distance from the New York mine.

"There seem to be two rather distinct facies of the Franciscan formation in this district. The rock exposed in the lower parts of the canyon weathers in larger and more angular blocks of darker color than the overlying rocks that are exposed along the mail trail near the Buclimo mine and on the upper part of the ridge north of Willow Creek canyon. So far as known, serpentine does not occur in the overlying rocks. These upper rocks weather in small fragments, more like shales, though fresh exposures show that they are fine-grained sandstones, composed of essentially the same materials as the slightly coarser sandstones of the lower series.

"The heavy growth of underbrush and the deep accumulations of broken rock and soil, even on steep slopes, make study of the structure very difficult. Practically all the readings taken on the west side of the summit gave strikes of N. 50°-70° W. and dips of 20°-60° NE. East of the summit the strike is more nearly N. 45° and the dip 65°-70° NE. It is judged that this particular part of the Santa Lucia Range is a monoclinal tilted block, lying between a fault whose escarpment forms the north-eastward-facing wall along Nacimiento River and another fault represented by the scarp along the coast. These faults trend approximately N. 40° W. The trace of a majo seen in every exposure.

MINES.

Most of the properties in this district have been active during short and irregular periods only. Abandonments and relocations of claims with a change of names have been common and it is difficult to give a connected account of the operations at any of the mines. The most recent and important developments have taken place at the New York Mine. Development work is going on at the present time (January, 1925), at the New York, Mariposa and Oregon Mines, but practically all the others are idle.

Brewery Mine. S. O. Pugh, owner, Soledad, California. This property is located in Sec. 2, T. 24 S., R. 5 W. The gold is free in a quartz vein in 'slate,' and is said to average about \$8.00 per ton. Referring to this property, at the time of his visit, Hill² says:

"The Brewery tunnels are north of the trail, about 200 feet down the slope toward Willow Creek from the mail-trail ridge and 1 mile west of Melville's cabin. They were caved at the time of visit, but apparently were run on a ledge that strikes N. 80° W. and in the cuts dips 60° S. As exposed in the cuts, the ledge matter is 6 feet wide and consists of fine-grained black sandstone, with veinlets of quartz and a little siderite. No sulphides were seen on the dump, but small casts of cubical outline filled with limonite indicate that the mineralization is similar to that on the Buclimo."

Bibl: State Mineralogist's Reports VIII, p. 409; XV, p. 603.

Brooklyn Mine. Owner, James H. McNeil, Dutton Hotel, Jolon, California. This property consists of one claim, situated in Sec. 2, T. 24 S., R. 5 E., M. D. M., and lying parallel to the New York Mine. Development has all been by open cuts. These have exposed a lode, containing quartz stringer veins, carrying free gold, rich in places. The country rock is slate and sandstone. Idle.

² Hill, J. M., idem, p. 328.

Buclimo Mining Co. Address 709 Balboa Building, San Francisco; Dr. C. A. Clinton, Twenty-first and Howard streets, San Francisco, president. This property has not been operated since the period of the world war. The Buclimo is located in Sec. 2, T. 24 S., R. 5 W., M. D. M., at an elevation of about 2800 feet. It includes the Last Chance, East Extension No. 1, West Extension No. 1, Mary S., Mary S. Extension, Gold Gulch Nos. 2, 4, and 5, Good Gold, Flat View (camp site), Ora F. Nos. 1 and 2, Rankin, Perry, Lucky Jim, and Pansy Fraction. It was visited by J. M. Hill³ in 1921, who says:

Fraction. It was visited by J. M. Hill³ in 1921, who says:

"The Buclimo (Last Chance) workings were not accessible. From the surface work it is judged that at least four nearly parallel lodes exist on the property. These strike N. 80° W., and, to judge from the northerly dips at the surface, the ledges may come together with depth. It is said that from the surface to the tunnel level, 85 feet below, the lode has been stoped for a width of 10 feet and a length of 500 feet. A little ore presumably from the tunnel level, found in a mill bin, showed quartz-calcite veinlets, with pyrite and arsenopyrite in crushed, somewhat mineralized dark-colored sandstone and shale. The upper workings are reported to be abandoned now, and a long crosscut tunnel has been started from the level of Alder Creek, near the Grizzley incline. This crosscut is more than 1800 feet long, but has not reached the vein. It was run in a direction almost parallel to the vein and the strike of the sandstone beds. The first 200 feet of the crosscut is in medium-coarse sandstone; next there is 100 feet of black chert; and the remainder of the tunnel is in nearly black sandstone that is almost fine grained enough to be termed slate. This tunnel shows the formations to be very much broken and faulted, most of the movement being parallel to the bedding in dip as well as in strike, but with many planes of minor movement showing parallel strike but much steeper dip than the bedding."

The Buclimo is equipped with a 5-foot Huntington Mill, Frue concentrator and accessories. The mine has been idle since about 1917. The president of the company was expected on a visit to the property in January, 1925, which may indicate a renewal of activities.

Bibl: State Mineralogist's Reports VIII, p. 405; XI, p. 261; XII, p. 184; XIII, p. 234; XV, pp. 603-604.

Bushnell Mine. This property has not been mentioned in our earlier reports, and the following notes are from the paper of J. M. Hill⁴, who visited the property in 1921.

"The Bushnell property is on the point between the Middle and North Forks of Willow Creek. The developments consist of an inclined shaft and a crosscut tunnel, 330 feet in all. The incline is sunk 130 feet on the intersection of a north-south fracture that dips 50° E. and a N. 50° E. stringer that dips 50° SE. It is reported that about \$9,000 in free gold was milled from the ore obtained in sinking this shaft. At the tunnel level the north-south fracture is barren; the N. 50° E. fissure ranges in thickness from a knife-edge to 3 inches and is filled with white quartz, calcite and fragments of wall rock, the whole much crushed and shattered. A little free gold is visible in some of the quartz, but no sulphides, limonite, or other indications of the former presence of sulphides were noted in the ore."

Gorda Mine. Owned by the Gorda Gold Mining Co. Mr. George Reed, manager, Gorda, California. This property is located on Spruce Creek in Sec. 4, T. 24 S., R. 5 E., at an elevation of 2000 feet. In describing it at the time of his visit in 1921, Hill⁵ states:

"In 1902 several exceptionally large rugged gold nuggets were found in the stream bed nearby. Considerable money was spent in equipping the property for hydraulic work, and a little more gold was obtained. The talus and soil cover, however, were so deep that the stream gravels had not been reached except over a short distance. A number of tunnels have also been run in talus to locate the rim of the covered channel, and some work has been done in the sandstone on the north wall of the gulch in the hope of discovering the source of the coarse gold, but this object had not been reached in 1921. The sandstone cut by this tunnel is peculiar in that it contains small flat fragments of black slate, minute red garnets, and a small amount of finely disseminated pyrite. The mineralization is localized in the sandstone within 150 feet of a considerable outcrop of serpentine."

The mine is idle at the present time (January, 1925).

Bibl: State Mineralogist's Report XV, p. 604.

Idem, p. 327.
 Hill, J. M., U. S. Geol. Survey Bull. 735, p. 329.
 Hill, J. M., U. S. Geol. Survey Bull, 735, p. 328.

Hammond Claims. There is no data on this property, under the above name, in former reports of the Bureau. J. M. Hill, however, refers to it in his report on the Los Burros district in the following

"In the canyon of the South Fork of Willow Creek, F. C. Hammond has several prospects on N. 80° W. zones of mineralization in the slates and sandstones. The metalliferous minerals here consist largely of disseminated pyrite and chalcopyrite in hard dark-colored sandstone along a series of nearly vertical tight fractures. No arsenopyrite was noted. There is practically no oxidation on any of the ledges, though a little iron and copper stain is to be seen directly on the surface. At one of Mr. Hammond's claims, on the ridge between South Fork and Willow Creek, pyrite and a little chalcopyrite are disseminated along a shear zone in garnetized sandstone about 25 feet from a lens of serpentine. Very minor amounts of copper silicate and limonite coat the joints at the surface."

Manchester. (Blue Jay), owned by S. O. Pugh, Gorda, California. Idle.

Bibl: State Mineralogist's Report VIII, p. 407; XV, p. 605.

Mariposa Mine. This mine is located in Sec. 2, T. 24 S., R. 5 E., at an elevation of approximately 2700 feet. It is near Spruce Creek and includes the following claims: Blue Jay Nos. 1 and 2, San Lucas, Protection, and McKinley. The gold occurs free in quartz ledge which carries some arsenopyite. In January, 1925, a crosscut tunnel was being driven to cut the vein. Three men were working.

Bibl: State Mineralogist's Report XV, p. 605.

M. M. Mine (Melville). This property consists of 22 claims, owned by H. F. Melville, Palisade and Pinnacles, via Soledad, California. They are situated on Gold Ridge between two forks of Willow Creek, and appear to be a continuation of the Buclimo lode. A large open cut below the trail exposes a crushed ore zone, containing stringers of quartz, and having a width of 10 feet or more. The entire crushed zone is said to carry some gold. A rough concentration by panning showed the presence of pyrite and arsenopyrite.

Bibl: State Mineralogist's Reports VIII, p. 408.

New York Mine. Owner, New York Mining Co., a private company, composed of Wm. Cruikshank, John Harboldt, Jas. Trickle; and Donald and J. C. Lazier, of Gonzales, California. The New York was discovered by a man named McCormick about 1904. It is located in Sec. 1, T. 24 S., R. 5 E., on Ajax Mountain. J. M. Hill at the time of his visit (1921) states:

"At the New York property, on Ajax Mountain near the summit, two narrow veinlets, about 18 inches apart, constitute the lode. The crushed, contorted rocks between the veinlets carry pyrite and arsenopyrite, with very minor amounts of chalcopyrite and galena. Complete oxidation on this lode has extended to a depth of 50 feet and mining to that depth has yielded some fairly good free-gold ore. Two tunnels, a few hundred feet in total length, have been driven in the sulphide zone. The sulphides are in very small crystals and appear to have been deposited subsequently to a period of crushing of the original quartz veins. Arsenopyrite predominates over pyrite."

Development has continued since the above was written. crosscut tunnel, 200' below the outcrop, has been driven 440 feet, at which points it cuts a vein 3 to 4 feet in width, carrying good values over a width of 20 inches to 3 feet or more. There are 12,000 to 15,000 tons of the ore on the dump ready for milling. A Straub mill with amalgamating plate and Overstrom table, driven by gas engine, had just been installed (January, 1925), and preparations were being made

 $^{^6}$ Hill, J. M., U. S. Geol. Survey Bull. 735, p. 328. 7 Idem, p. 327.

to start milling. In the lower level nearly, if not all, the values are in the form of sulphides, which carry very little silver. The concentrates will be packed out over the trail to Jolon. A new coast road from the south has been built as far as Salmon Creek, and if this is extended as contemplated, it will aid greatly in the development of this and other properties.

Oregon Mine. This property adjoins the Mariposa and consists of the Oregon and Cool Springs claims. It is in Sec. 2, T. 24 S., R. 5 W., at an elevation of 2700 feet. J. M. Krenkel, owner, Gorda, California. The gold occurs free in a quartz ledge which contains some hematite near the surface. Considerable work has been done in the course of assessments, and Krenkel and his sons were continuing development in January, 1925.

Bibl: State Mineralogist's Report XV, p. 605.

Plaskett Mine. (Ocean View; also known at one time as Howard Mine.) L. M. Plaskett, owner, Gorda, California. The mine is located in Sec. 30, T. 23 S., R. 5 E., at an elevation of about 900 feet. It was formerly under lease to W. C. Howard, of San Francisco, and was equipped with a 3½-foot Huntington Mill run by a gas engine. Development since our previous report was noted by Hill^s in 1921, who says:

"It is developed by an 86-foot incline, with short drifts to the northwest at 40 and 80 feet and a 100-foot drift tunnel to the southeast on the 40-foot level. The ledge strikes N. 45° W. and dips 10° NE., at the surface but steepens to 60° at the bottom of the incline. It consists of crushed white quartz, slightly iron strained but with no visible sulphides. It is reported that \$18,000 in free gold was recovered from float picked up below the croppings and from ore obtained in sinking the incline. It is judged that the free gold occurred in a small lens, for the quartz exposed in the workings appears to be barren."

Idle in January, 1925.

Bibl: State Mineralogist's Report XV, p. 605.

Sandall Property. There are two claims in this property, the Gold Ore No. 2 and the Helen Davis. Mrs. John A. Sandall, owner, 3674 Sixteenth street, San Francisco. They are located in Sec. 35, T. 23 S., R. 5 E. A tunnel 67 feet in length on the Gold Ore No. 2 cut a small vein carrying free gold. Assessment work only is being done.

NEW LOCATIONS.

Recent locations in the Los Burros district include the Fighting Bob No. 1, on the north side of North Fork Dog Vine Creek, formerly the Good Brothers claim. Abel A. Collins, 336 Monterey street, Salinas, California, owner.

Philip Krieger has recently located the Evergreen Placer and the Brown Eagle Nos. 1, 2 and 3, quartz claims.

JOLON DISTRICT.

The Ruby Placer Mine is located about three miles northwest of Jolon, on the Milpitas rancho in Old Man's Cañon. It is owned by Messrs. H. and W. T. Hess of San Francisco.

In the spring of 1914 the Hess Brothers installed a hoist with dragline bucket. Water was obtained from dams in the cañons where winter flood waters were held. The gravel was washed through a rotary tube screen run by a gas engine. Several experiments were made and although it is said the color in the pan ran as high as 50

⁸ Hill, J. M., U. S. Geol. Survey Bull. 735-J, p. 329.

cents per cubic yard, the recovery with the screen and riffle board was too poor to make it a paying proposition. There has been no recent attempt to work this property.

Bibl: State Mineralogist's Reports VIII, p. 405; XV, p. 606.

PARKFIELD DISTRICT.

On the *Cholame Grant*, 7 miles southeast of Parkfield, there is a series of gulches with gravel deposits which have yielded some placer gold. It is locally known as 'Gold Hill.'

Summary.

Gold in Monterey County is found in quartz veins in the metamorphic rocks and as placer gold in Pleistocene gravels. Gold in the quartz veins is free milling down to the water level and rich pockets have been found. The veins are narrow, however, and considerable wall rock must be worked. Below the water level, which is usually about 150 feet below the surface, sulphides are encountered. The value of these sulphides has not been fully ascertained but some specimens examined showed no secondary enrichment.

Placer gold has been obtained both from raised beaches along the west coast and from loose raised gravel deposits west of Jolon. Deposits of considerable extent remain which only await a profitable

method for extraction.

LIMESTONE and MARBLE.

A belt of limestone shows in several places on the west slope of the Santa Lucia Range, not far from the coast line. It outcrops in the north on Long Ridge in Sec. 9, T. 18 S., R. 1 E., and runs in a southern direction to Sec. 36 of the same township, and Sec. 31, T. 18 S., R. 2 E. It is prominently exposed on Pico Blanco in Sec. 36. Deposits of possible economic importance occur on the ranch of Mr. John Little of Monterey, south of Point Sur; and on the 640-acre ranch of Mrs. C. L. Koch of Pacific Grove, in Sec. 36, T. 18 S., R. 1 E., which includes in part the deposit on Pico Blanco. A landing place suitable for shipping from the latter deposit is said to exist north of Point Sur and 5 miles from Pico Blanco, Burned lime was at one time produced from a quarry in Sec. 16, T. 18 S., R. 1 E. A conspicuous cuterop also occurs on Sec. 30, T. 19 S., R. 3 E. Farther down the coast burned lime has been produced from deposits in Sec. 22, T. 22 S., R. 4 E. Notable deposits of limestone, often crystalline, are likewise found at various points in the Gavilan Range in this county. An undeveloped deposit of white marble is reported in Sec. 6, T. 23 S., R. 14 E., near Parkfield.

Bibl: State Mineralogist's Reports IV, p. 110; VI, pp. 29, 97; VIII, p. 410; XI, p. 260; XII, p. 392; XIII, p. 629; XV, pp. 599, 606; Bull. No. 38, pp. 72, 73.

Alisal Ranch Deposit. Owners, Martha E. Bardin, Hazel J. Hurt, and Ethel O. Tholcke, all of Salinas. This deposit, a little north of east and about 7 miles distant from Salinas in the foothills of the Gavilan Range, lies at an elevation of about 700 feet. In former years the narrow gauge railroad of the Spreckels Sugar Co. extended to it, and most of the limestone produced has been used by the Spreckels Co. A portion of the track has been taken up so that the deposit is now

1½ miles from the end of the road. The limestone is massive, but not suited for technical use in sugar making, as carried out in the Spreckels plant in recent years, and there has been no production for about 15 years.

Kellogg Ranch Deposit. A similar deposit, owned by the same parties as the Alisal Ranch deposit, is located farther southeast and about 16 miles from Salinas. Limestone of similar quality found here was also used by the Spreckels plant at one time. The deposits are very large and their accessibility to railroad, location adjacent to the clay deposit at Heins Lake, and their relative closeness to gypsum deposits near King City, offer possibilities for the establishment of a cement industry. A pumping station and the oil pipe line of the Associated Oil Co. is located about 2 miles south of Salinas.

Los Vergeles Ranch Deposit. This deposit is situated on Lots 1 and 3 of the Los Vergeles Rancho. The property has an area of 250 acres, and is owned by the Commercial Lime Co., Henry A. Schulze, president, 5163 Eagle Rock Blvd., Los Angeles; Burke Corbet, First National Bank Bldg., San Francisco, secretary. Dr. J. H. Wythe, 418 Consolidated Bldg., Hill and 6th Streets, Los Angeles, who discovered the deposit and owned 2500 acres of the Spanish Grant land upon which it was found, sold it to the above company, in which he holds a controlling interest.

The deposit is about 12 miles northeast of Salinas on the state highway running from Salinas to San Juan. The highway cuts across the face of two exposures, covering 43 acres, and passes between two other large deposits $2\frac{1}{2}$ miles from the former, on the remaining

207 acres.

The greater portion of the limestone lies above the highway and can be brought to it with the aid of gravity. A tunnel (closed) was placed under the highway at the time of its construction, and the right of way deed provides for the working of the deposit through this tunnel so there can be no interference with quarry operations.

A power line crosses the land, and the Associated Oil pipe-line and

pumping station is located within about 14 miles.

The limestone ranges from a coarsely crystalline white and bluish-white calcite to a very compact holocrystalline, fine-grained marble. It averages very high in lime content. Some of this limestone has been used by the Judson Iron Works, but production to date has been limited.

Bibl: Cal. State Mining Bureau Bull. 38, p. 73.

MAGNESITE.

Nevins Magnesite Deposit. F. M. Nevins, P. O. Box 545, Coalinga, California, owner. This holding comprises 80 acres in Sec. 29, T. 23 S., R. 15 E., M. D. M., about 4 miles east of Parkfield, near Table Mountain. There is a deposit here of undetermined extent, it having been prospected only slightly by open cuts.

An analysis of the magnesite follows:

	Per cent
SiO ₂	1.12
Al ₂ O ₃	.14
Fe ₂ O ₃	.11
('a()	
Mg()	45.70
Loss	51.40
Total	99.93

Purity as magnesium carbonate, 95.56%.

A little farther along magnesite also shows in Secs. 34 and 35, T. 23 S., R. 15 E., at the base of Table Mountain.

MINERAL WATER.

Monterey Mineral Well. This property is owned by O. P. Col-



Open cut, Nevins' magnesite deposit.

burn, 622 Spencer street, New Monterey. California. The well was formerly known as O'Connor Mineral Spring, although it is a well, originally dug by O'Connor. The present owner bought the property in July, 1923, and has provided bathing facilities and established an auto camp ground in connection. The well is 50 feet deep, and 25 feet of water stands in it at all times. The water is pumped to a tank by a small pump, operated by electric motor; the tank supplying the baths, either hot or cold, and the bottling department. bottled, both as it comes from the well and artificially carbonated. It is said to be of particular benefit in the treatment of rheumatism, kidney, and stomach disorders. An analysis by E. J. Lea, Director of the State Laboratory, is reported as follows:

Analysis.

Analysis of the water from Monterey Mineral Well, as made by E. J. Lea, Director of the State Laboratory:

	Gms.	per 100	C
Total solids		.585	
Loss on ignition		.050	
Iron, alumina and phosphoric acid		.002	
Magnesium oxide		.035	
Chloride		.240	
Silica		.085	
Calcium oxide		.031	
Sulphate SO ₃		.020	
Phosphoric acid, traces only.			

SPRINGS.

The following data on the mineral springs of Monterey County, with the exception of a few notes regarding their ownership and accommodations for the public, are taken from the U. S. Geological Survey Water Supply Paper No. 338, 'Springs of California,' by Gerald A. Waring, 1915.

"Banes Soda Springs. Banes Soda Springs are situated on the coast about 6 miles southwest of the Cruikshank (Buclimo Mining Co.) Mines. Carbonated water issues for a considerable distance along a bluff that here borders the ocean and has deposited notable amounts of lime carbonate. At the main spring a terrace several feet in height has been built by the iron stained material that has been deposited from solution.

"The water apparently derives its contents of calcium and of carbon dioxide from limestone masses that are associated with the other altered sediments along this portion of the coast."

"Dolan's Hot Spring. A warm and mildly sulphureted spring exists on North Fork of Big Creek, about 1½ miles from the ocean and 7 miles by trail south of Slate's Hot Springs. The water issues in a deep portion of the cañon, which is heavily timbered with redwoods, and as the place is known only locally and is not easily accessible, the spring has not been made use of and has seldom been visited." Philip Dolan, owner.

"Helms Soda Springs. Helms Soda Springs are about 3 miles east of Banes Soda Springs. Their water is strongly carbonated, but the flow is slight, and they have not formed a notable deposit such as is found at the springs farther west."

"Hot Springs on North Fork of Little Sur River. Several thermal springs rise in the bed and along the banks of North Fork of Little Sur River, about two miles above the point at which the stage road crosses the stream. The springs in the stream bed form a warm pool, and on its right bank two or three flows, having a maximum temperature of 114°, issue from crevices in the rock and fill a small natural basin. The springs are in a narrow, rugged section of the stream cañon, in a granitic area, and possibly rise along fractures that have been produced by local faulting. The water is mildly sulphureted but it is not otherwise noticeably mineralized. A considerable amount of fibrous algous growth, from white to reddish purple in color, is found in the stream and the adjacent pools.

"During the nineties the water was piped to a grove of redwoods in a flat some distance below the springs, and it was the intention to build a hotel and bathhouse. High water washed out the pipe line, however, and in 1908 the attempt to develop the springs had not yet been renewed." J. and Annabel Brown, Salinas, California, owners.

"Paraiso Hot Springs. Paraiso Hot Springs are situated near the head of a small valley that opens eastward to Salinas Valley. Underground water lies at a shallow depth near the springs, beneath an area of several acres within which at least five mineral springs rise. The largest of these, which is known as the Soda Spring, has an observed temperature of 111°, and a discharge of perhaps 8 gallons a minute.

About 40 yards away two small Sulphur Springs rise with temperatures of 88° and 102°, and 100 yards farther east there are two drinking springs each of which yields perhaps one-fourth gallon a minute. These are known as the Iron Spring and the Arsenic Spring and have tem-

peratures respectively of 68° and 65° F.

"The springs at this place were known to the Catholic Mission Fathers, who at one time lived here. Their extensive modern use dates back more than 20 years, and their accessibility has made them an objective point for automobile parties. In 1908 accommodations were provided in hotels and cottages for about 200 guests, while tub and plunge baths at the Soda and the Sulphur springs, and a swimming plunge that was also supplied by these springs, gave ample opportunity for use of the waters. Analyses of the springs, made a number of years ago, are available and are here presented in the standard form.

Analyses of Water from Paraiso Hot Springs, Monterey County, California, (Constituents are in parts per million.)

	1	2	3	4	5
Temperature Properties of reaction: Primary salinity Secondary salinity Persalinity Primary alkalinity Secondary alkalinity Secondary alkalinity Subalkalinity	48°C.(118°F.) 81 2 0 0 17 22	48°C.(118°F.) 85 0 0 2 13 12	46°C.(114°F.) 69 10 0 21 39	21°C. (70°F.) 51 0 0 11 38 28	21°C. (70°F.) 82 17 1 0 0 51

Constituents	By weight	React- ing values	By weight	React- ing values	By weight	React- ing values	By weight	React- ing values	By wighte	React- ing values
Sodium (Na) Potassium (K) Calcium (Ca) Magnesium (Mg)	253 2.9 41 7.5	11.00 .07 2.04 .62	252 3.1 32	10.96 .08 1.60	233 6.4 28 38	10.13 .16 1.40 3.13	234 80 30 74	10.18 2.05 1.50 6.09	179 58 23 9.8	7.78 1.48 1.15
Iron (Fe) Aluminum (Al) Sulphate (SO ₄) Chloride (Cl)	7.3 5.1 493 38	.26 .56 10.27 1.07	19 463 39	.68 9.64 1.10	9.7 520 29	.35 10.83 .82	12 23 342	.43 .48 9.65	3.9 22 387	.14 .46 10.92
Carbonate (CO ₃) Arsenate (AsO ₄) Silica (SiO ₂)	79	2.63	56	1.87	94	3.13	304 Trace 156	10.13 Trace 5.18	176	5.84
Totals	977		917		1,002		1,255		859	
Carbon dioxide (CO ₂) Hydrogen sulphide (H ₂ S)	25	1.14	(a)		17 60	.77 3.52	(a)			

"The Hot Soda Spring is primarily saline in character with sec-The term "soda," ondary alkalinity as a subdominant property. usually referring to primary alkaline waters, is a misnomer. Hot Sulphur Spring differs from the Hot Soda Spring chiefly by reason of higher secondary salinity and its content of hydrogen sulphide. The analyses of the Arsenic and Iron springs are of doubtful authenticity. It is of interest that only a trace of arsenic was found in the Arsenic Spring and very little iron in the Iron Spring. Both have primary

Hot soda spring. Analyst and authority, Winslow Anderson, 1889.
 Hot soda spring. Analyst, A. Cihi, 1871. Authority, U. S. Geol. Survey Bull. 32.
 Hot sulphur spring. Analyst and authority, Winslow Anderson, 1889.
 Arsenie spring. Analyst, A. Cihi. Authority, advertising matter.
 Iron spring No. 2. Analyst, A. Cihi. Authority, advertising matter.

salinity for the principal property. High magnesium with respect to

calcium is indicated for the Hot Sulphur and Arsenic springs.

"The hills on each side of the little valley at Paraiso Springs consists of gravelly sandstone that dips gently away from Salinas Valley. Granitic boulders scattered along the ravines indicate that crystalline rocks are exposed to the west. Although a fault is mapped through Salinas Valley, it is not believed that such structure has given rise to Paraiso Springs. It seems more probable that some local fold or bedrock obstruction here forces underground water to the surface, and that its thermal character may be due to the depth from which it rises, in a locality of unusually high temperature gradient."

Paraiso Hot Springs is situated at an elevation of 1400′, and is easily reached, being only 7½ miles from Soledad. The resort is open the year round, and it is one of the popular mineral spring resorts of the state. O. B. Peterson is owner-manager, Paraiso Springs, California.

"Slate's Hot Springs. In the Coast Ranges of Monterey County thermal springs of note issue at four places. The southernmost of these is at Slate's Hot Springs, on Mr. J. A. Little's ranch. The water here issues at ten principal points in a distance of 125 yards, halfway up the face of the bluffs that here border the ocean. A small private bathhouse has been built near the easternmost spring. The waters range in temperature from 110° to 121° F., are mildly sulphureted, and the run-off streams are lined with abundant green algous growth. Small deposits of alum, gypsum, and carbonate of lime or magnesia were noted at the edge of one spring. The waters taste distinctly sweetish.

"About one-fourth mile northwest of the main group, on the left bank of Hot Creek, is another spring, 98° in temperature. This spring yields perhaps 5 gallons a minute and is used for laundering clothes.

"It is said that the location of the springs was described by an Indian to Mr. Thomas B. Slate, who made his way southward with difficulty along the steep, brushy slopes, and succeeded in finding only the warm spring beside the creek. Later, however, he came down the coast in a boat, found the springs on the bluff, and settled near them in 1868.

"Sulphur Spring on Mission Creek. About 12 miles west of north from Jolon post office, or 10 miles from San Antonio Mission, there is a cool sulphur spring that has been used to a slight extent as a drinking spring. It is not near a main traveled road, however, and is not widely known. The spring apparently issues from sedimentary materials, probably of Tertiary age, that form the hills bordering the west side of Salinas Valley. It is on the Milpitas Rancho."

"Tassajara Hot Springs. A large amount of hot water issues at Tassajara Hot Springs, which are in the cañon of Arroyo Seco, in the southern part of Monterey County. About seventeen thermal springs may be counted here, in the bed of the creek and along its southern bank. They range in temperature from about 100° to 140° and from mere seepages to flows of seven or eight gallons a minute.

"The thermal waters issue from a gneiss that is exposed along the creek for a distance of 200 yards or more. Above and below this exposure the rock is granitic and in some places contains small garnets. The crystalline rocks are overlain by a series of shale, sandstone, and limestone, whose structure in the area north of Arroyo Seco is well shown by the beds of massive buff-colored sandstone that dip north-

eastward at an angle of about 45°. A western limb of this structure was not seen, though it may exist in the mountains farther coastward. The observed dips at least suggest that Tassajara Hot Springs issue at a locality where Arroyo Seco crosses a zone of intense pressure in the

crystalline rocks.

"The springs received their name from an Indian or Mexican word that means 'the place where meat is cured by drying,' and dates from the early days of the eattle industry. The springs have thus been known and used for many years, and they were early visited by campers, when the only access was by means of a difficult trail. Several years ago a well-graded wagon road was built southward from Jamesburg across the mountains and down into the cañon, and the springs are now easily reached by stage. In 1904 a stone hotel was built, and other improvements have been added yearly, so that in 1909 there were ample accommodations for 75 people, though a larger number has been taken care of by the use of tents. Water from two of the largest springs has been piped to tub and plunge baths, and a vapor bath has been constructed over the hottest spring, which issues in the creek bed.

"Analyses of two of the thermal waters were made. These waters are noticeably sulphureted, and the analyses show them to be only moderately mineralized. The water of the arsenic spring has a distinctly yellow color, which in a few other springs has been ascribed to

alkaline sulphides in solution.

"At the north edge of the creek, a few yards above the hot springs, there are two cool springs in which iron is deposited. An analysis of the easternmost of these springs is tabulated with the hot springs.

Analyses of Water from Tassajara Hot Springs, Monterey County, California. (Analyst and authority, F. M. Eaton, 1909. Constituents are in parts per million.)

	1	2	3
Temperature	59°C. (138°F.)	39°C. (103°F.)	18°C. (64 F.)
Properties of reaction: Primary salinity Secondary salinity	63	65 0	19
Persalinity Primary alkalinity	0 30	0 26	
Secondary alkalinity Subalkalinity	7 138	104	6

Constituents	By weight	Reacting values	By weight	Reacting values	By weight	Reacting values
Sodium (Na) Potassium (K) Calcium (Ca)	81 4.6 5.3	3.51 .12 .27	75 4.8 4.0	3.26 .12 .20	} 14 33	0.59
Magnesium (Mg) Iron (Fe)	Trace 1.5	.05 2.29	1.3 2.0 109	.11 .07 2.27	$ \left\{ \begin{array}{c} 11 \\ 0.8 \\ 1.9 \\ 36 \end{array} \right. $.87 .08 .21
Chloride (Cl) Carbonate (COs) Arsenate (AsO _s) Silica (SiO ₂)	6.5	1.37 3.90	5.0 38 (a) 0 116	.14 1.28 .00 3.84	12 61 (?)	2.03
Totals	368		375		170	
Carbon dioxide (CO2) Hydrogen sulphide (H2S)	0 25	1.47	(b)	.00	(b) (?)	

⁽a) Not detected in 1 liter of water.(b) Present.1. Lower of two main basins.2. Arsenic spring.3. Iron spring.

The two hot springs were apparently from the same general source, showing only slight difference in composition. Primary salinity and primary alkalinity are the chief stable properties, but the waters are characterized by high tertiary alkalinity, of which silica is the chief component. The carbonate radicle reported is presumably calculated from the alkalinity determination and doubtless includes sulphides and possibly silicates. The apparent absence of arsenic in the so-called arsenic spring is noteworthy.

"The iron spring is of markedly different character from the hot springs, being less than half as concentrated and having secondary alkalinity as the dominant property. Tertiary alkalinity is not reported, but this property is probably relatively low. It is probably of essentially surface origin, and not directly related to the thermal

waters.

"The following notes concerning algous growths in the creek below the hot springs are here given, as the growths are related to the sulphureted character of the water. Although they are common to thermal sulphur springs, the relatively large volume of water in the creek at Tassajara Hot Springs, its comparatively slow cooling, and the presence of both swift currents and of quiet pools, affords an unusually good opportunity to observe the variation in character of the growth.

"At the main springs, where the temperature of the water was 110° to 140°, the material was mainly fibrous, and white, green, and reddish-

brown in color.

"About 75 yards below, at a temperature of 96°, there was a dark green layer on the bottem of pools, with a small amount of white material on the surface of the green. Where the current was swiftest a purple-brown, furry growth, one-eighth to one-quarter inch thick, covered the rocks.

"At 125 yards, where the temperature was 91°, a green, leathery growth covered portions of the bottom, with white, feathery streamers

attached to it where the current was rapid.

"At 200 yards, in a temperature of 87°, a thick, leathery growth coated the entire stream channel, being green and white on its upper surface, pale purplish-red inside, and black on the under surface. A number of pale purple, feathery, and white threadlike streamers extended from it.

"At 250 yards, in a temperature of 83°, there was a layer of green

material in the pools, and white material in the swifter water.

"At 275 yards, where the temperature was 81°, the lower limit of white growths was reached. Below it a dark green moss coated the rocks for a distance of about 50 yards to a point where the temperature was 78°. Below this point there was no notable growth in the channel.

"The material showed a tendency toward brighter colors in the hotter water and more sombre ones in the cooler places. White material (probably due to the deposition of sulphur) was more common in the hottest water and in the lowest portions of the algous growth. Smooth, leathery growths lined the pools, while fibrous growths were formed in the swiftest currents. The discharge of the stream was approximately 100 gallons a minute. The water first rose at a point about 50 yards above the main springs. Above this point the stream channel was dry."

Tassajara Hot Springs is a popular resort, open from May to October and reached by auto stage from Salinas over a 60-mile road, winding for a good part of the distance through the rugged Coast Range. Additional accommodations, including a large annex and tent houses, have been installed as patronage has increased. Mrs. Helen G. Quilty, owner, Tassajara Springs, California.

MOLYBDENUM.

Molybdenite occurs in quartz on the Westcott Ranch, 8 miles east of Soledad. About 5 years ago the *Vancouver Pinnacles Molybdenum Co.* did some work on a prospect here, but nothing of importance was developed.

Bibl: State Mineralogist's Report XVII, p. 156.

NICKEL

The mineral zaratite, an emerald-green hydrous carbonate of nickel, has been found as a coating on chromite in Monterey County.

Bibl: Blake, W. P., Report, State Board of Agric., 1866.

PETROLEUM.

The possibilities of developing oil in Monterey County in commercial quantities are discussed in Bulletin No. 89, of the State Mining Bureau, 'Petroleum Resources of California,' by Lawrence Vander Leck, 1921. It is further discussed in Bulletin No. 69, 'Petroleum Industry of California,' by R. P. McLaughlin and C. A. Waring, 1914, and much of the geology of the county is mapped in the geological folio accompanying the latter bulletin. Development operations are reported in current issues of the 'Summary of Operations, California Oil Fields,' issued monthly by the Department of Petroleum and Gas of the State Mining Bureau.

No attempt, therefore, was made to include this phase of the mining industry in the present report.

Bibl: State Mineralogist's Report VIII, p. 444; XII, pp. 356, 493; Journal of Geology, Vol. 9, pp. 330–336; Cal. State Min. Bur. Bull. 19, pp. 143–146; 69, pp. 418–438; 89, pp. 31, 32, 82–94; U. S. Geol. Survey Water Supply Paper 89, pp. 13–19; U. S. Geol. Survey Bull. 581-d; 603; 691-h.

QUICKSILVER.

The quicksilver mines in Monterey County from which commercial production has come are associated with an area of serpentine near Parkfield, in the southeastern corner of the county. The output to date has come in the main from one property, the Patriquin Mine.

Dutro Mine. Situated in the SW 4 of SE 4 of Sec. 28, T. 24 S., R. 6 E., M. D. M. Idle for more than ten years past.

Bibl: State Mineralogist's Report XV, p. 613; Bulletin No. 27, p. 124; State Mining Bureau Bull. No. 78, p. 73.

Monte Cristo Group. In the southwestern part of the county near Gorda.

Bibl.: State Mining Bureau Bull. No. 78, p. 73.

Patriquin-Gillett Quicksilver Mining Co. This company produced a few flasks of quicksilver in 1917 from their lease in Sec. 1, T. 23 S., R. 14 E., M. D. M., $5\frac{1}{2}$ miles north of Parkfield. They are no longer operating.

Bibl.: State Mining Bureau Bull. No. 78, p. 73.

Paloma Mining Co. (Patriquin Quicksilver Mine; also at one time called Pitt; also Cholame-Parkfield; and Parkfield Mine.) This mine has been the principal quicksilver producer in Monterey County. It is situated in Sec. 2, T. 23 S., R. 14 E., 6 miles north of Parkfield. The owners are Louis Patriquin, M. C. Parks, F. A. Anstey, A. J. Piezzi, and O. H. Poehlmann; operating as the Paloma Mining Co.; M. J. Eunson, superintendent.

The present company took over the property on August 16, 1924. Extensive improvements in the reduction equipment and surface plant have been made; a new 60-ton Gould rotary furnace and condensing system being the principal addition. The crushing plant has been reconstructed and an automatic Challenge feeder added.



Rotary Furnace Reduction Plant at Patriquin Mine; Paloma Mining Company (in course of construction), near Parkfield.

Ore from the three tunnel levels is trammed direct to bins above the furnace and dumped on a grizzley, the oversize being broken in a Dodge jaw-crusher. It is drawn from the bins by a Challenge feeder which discharges to a screw feeder 10 feet long, extending through the dust chamber. The screw feeder is driven at 135 r. p. m. The dust chamber is of brick and concrete construction with compression joint between it and the rotary kiln. The rotary furnace is 40 feet in length by 3 feet diameter and is geared to make one complete revolution per minute. It is of the tire-type, resting on roller bearings, and is lined with fire brick. A 15-h.p. Fairbanks-Morse gas engine drives all the machinery except the ore-bin crusher which has a separate drive. Fuel oil is hauled in a tank by truck from Coalinga and delivered to three 200-barrel storage tanks. A Witt oil burner is used and a 40-cu. ft. capacity compressor supplies air at 50-lbs. pressure for the burner. There is a

concrete draw pit underneath the discharge end of the furnace of 3-tons capacity for the burned rock. A wooden pipe leads down from the top of the dust chamber to the concrete condensing chambers. In this connecting pipe are 4 water sprays and this is the only point at which water sprays are used. The condenser system comprises a concrete base and wooden top section connected by 8 vitrified pipes set at an angle



Condensers at Patriquin Mine, Paloma Mining Company. Open cut for rotary furnace draw-pit in foreground.

of about 45°. The fumes pass up the first pipe, down the second, up the third, down the fourth, etc., finally down the last one (in foreground in photo) then back under the set and through a further section of pipe resting at an angle of about 30° to a second concrete chamber and then through approximately 100 feet of pipe resting at an angle of about 30°, to the stack, from which a thin light-colored vapor issues. At the

time of visit the plant had been in operation only 5 days and sufficient time had not elapsed to gather reliable data in regard to details of operation, as adjustments incident to a new plant were still being made. It is operated three 8-hour shifts, one man per shift being in charge of the furnace. The plant and camp is electric lighted, a 40-light, 120-volt generator supplying current for all needs. Sixteen to eighteen men are employed underground and on top. All three levels of the mine are being worked, but most of the ore is coming from No. 1 and No. 2 levels. The fire-box of the old Johnson-McKay pipe retort furnace is being rebuilt to permit the use of oil fuel. It will be used for retorting soot and in cleaning up.

Bibl: State Mineralogist's Report XV, p. 613; Cal. State Mining Bureau Bull. 78, pp. 73–75; Bull. 27, p. 123; U. S. Geol. Survey Min. Res. 1915, Part I, p. 269.



Harvesting salt at plant of Monterey Bay Salt Company at Moss Landing, Monterey County, California. Photo by Walter W. Bradley.

ROCK AND GRAVEL INDUSTRY.

No rock-crushing plants are operating in the county, so far as could be learned, sand alone being produced at the present time. Gravel strata, in benches of the Salinas River on the east side, 3 miles north of King City on the road to Metz, have been utilized to some extent in the past. They are interbedded with sand and clay.

Hatton Ranch Deposit. (See Meadows Gulch Deposit, under Structural Stone.)

SALT.

Monterey Bay Salt Company. Vierra Bros., owners, Moss Landing, California. This property is located at sea level at Moss Landing. The Pajaro Valley Railroad (narrow gauge) connects it with Watsonville. It is also on a steamer landing, as indicated by the name.

Salt is extracted from sea water at this plant by solar evaporation. The salt works comprises four ponds. Two months are required for the water to evaporate to the density at which the salt crystallizes out and settles on the bottom of the ponds. The layer of crystals is from 4 inches to 6 inches in thickness.

After the salt has formed, the ponds are drained and the salt is then broken up with shovels and pumped, with saturated brine as a carrier, to a washing plant. Here it is washed, then crushed and screened, and put on the market without further refining.

The product is sold mostly to fish-curing plants at Monterey and to ice cream plants, dairies, and cattle men. Nine or more men are

employed in season.

The salt from the waters of the Pacific at this point shows a high analysis, and is said to be more uniform than that from San Francisco Bay water on account of the river waters flowing into the latter. It contains very little magnesia. An analysis of a moisture-free sample shows:

	er cent
Sodium chloride (Na Cl)	99.75
Magnesium chloride (Mg Cl ₂)	0.00
Sodium sulphate (Na ₂ So ₄)	0.05
Calcium sulphate (Ca So ₄)	0.14
Water insoluble matter	0.06
Organic matter	nil
Total	00.00

Bibl: State Mineralogist's Reports XV, p. 614; XVII, p. 157.

SAND.

Carmel Development Co. A sand deposit in the form of a large dune near Carmel, formerly owned by this company and utilized to some extent for the production of sand, has been sold to the City of Carmel for playground use.

Del Monte Properties Co. C. S. Olmstead, manager, Pacific Grove; A. J. Gunnell, sales manager, Crocker Building, San Francisco. This company is producing sand on a large scale from two deposits lying between Pacific Grove and Carmel. The principal operations are at the Lake Magella plant three miles west of Pacific Grove near Asilomar. The deposit here consists of large wind-blown dunes extending along the coast for several miles. Extensive alterations have been made in the treatment plant since which time only a small percentage of the output has been sold as 'pit run' sand, practically all of the product, both from the Lake Magella dunes and the Fan Shell beach workings, 4 miles farther down the coast, now being put through the plant and prepared for the various market demands. At the Lake Magella deposit the sand is brought direct to the plant by an electrically-operated drag-line scraper of the V-type. At the Fan Shell beach working the sand is raised into 150-ton bins by a gasoline-operated drag-line scraper, and is then transported by a fleet of five 5-ton trucks to the Lake Magella plant.

At the plant the sand from both workings is passed over special Overstrom concentrating tables of approximately twice the standard length, using fresh wash water from the company's distributing system. The tables remove the garnet, iron, dirt, and most of the mica. From the tables it is pumped by centrifugal sand pumps to a drainage room.

From the drainage room it is taken by conveyor to the steam dryer, housed in a brick building. Here it is dried by indirect heat, by falling through a series of hot steam pipes supplied with live steam from an 80-h.p. oil-fired boiler. The dried sand is elevated and passed through specially designed air separators which remove the last traces of mica. It then goes to storage bins for sacking or loading direct into railroad cars. The plant is electrically operated throughout, about 175-h.p. being required. Eight to ten men are employed in its operation. The present capacity is 25 tons an hour of finished product, but this can be increased. The products are glass sand; building sand, including concrete, mortar and stucco sand; sand-blasting and foundry sand, filter sand, fine sand used in the manufacture of roofing paper, and sand for other miscellaneous uses. It is probable that the mica recovered will have a commercial value as a by-product, and the garnet also, if in sufficient quantity. Installation of the equipment outlined has only recently been completed, and the amount of such by-products that will be produced is uncertain.

Bibl: State Mineralogist's Report XVII, p. 157.

Lapis Sand Plant. Owner, Bay Development Co., Frederick Maurer, president; E. H. Rix, secretary and general manager; Charles Hall, superintendent, Lapis plant. Home office, foot of 4th Street, at Pier 54, San Francisco.

The Bay Development Co. owns 435 acres, comprising Lot 1, Rincon district, City Lands of Monterey, at Lapis, Monterey County. The property is on the west side of the Southern Pacific Railroad and state highway from Watsonville Junction to Monterey, a short distance south of the point where these roads cross the Salinas River. There is a spur track from Lapis to the company's plant. The property is practically all composed of sand dunes parallel to the coast of Monterey Bay, and varies in elevation from sea-level to about 100 feet above. There is no timber or overburden. Water is obtained from wells. The deposit was first opened up in 1906, but the present company did not begin operations until 1918. Sand is being produced at two workings. No. 2 sand is obtained from the dunes and No. 4 sand from the beach working. Excavation is by drag-line scrapers, one being operated by a stationary hoist, and the other by a locomotive run back and forth on the railroad track. The latter is said to be both fast and efficient. The sand is loaded direct to cars without the use of any bunkers, screens or other machinery. Steam power is used, with oil for fuel, about 100-h.p. being required to run the plant. An average of 8 men are employed, and 160 cars per month are produced. The output is consumed in building and construction work for concrete and mortar, also for sand blasting, marble cutting, and as locomotive sand. The sand is hard and sharp, and is particularly well suited for sand blasting and cutting, but it contains too much iron to be used for glass making.

Bibl: State Mineralogist's Report XV, p. 614.

Otey Deposit. (See Meadows Gulch Deposit, under Structural Stone).

Pratteo Sand Pit No. 4. This sand deposit is situated 1½ miles north of Seaside on the Southern Pacific Railroad, and contains a total area



Lapis Sand Plant. Beach hoist getting out No. 4 sand.

of 30 acres. Owner, Pratt Building Material Co., 518 Hearst Bldg., San Francisco. C. F. Pratt, president; Howard Center, secretary; L. H. Wolmack, plant superintendent. Local postoffice, Seaside, California. The holdings include both beach and dune deposits which vary in elevation from sea-level to 100' in altitude. There is no timber or other overburden. The deposit was opened up in May, 1921. The beach sand is elevated by a drag-line scraper, dumping direct to R. R. cars. The dune sand is taken up by a conveyor-loader, which also discharges direct to cars. The plant siding will hold 12 cars. The sand is neither washed nor screened, but three grades are produced: No. 2 (fine) for mortar, No. 4 (coarse) beach sand, and a mixture of No. 2 and No. 4, which is used for concrete work. The entire output is used for building and construction work and sand-blasting. Electric power is used, 120-h.p. being required. Six men are employed and the output averages about 100 cars monthly.

SILVER.

Veins containing galena, thought to be argentiferous, were early reported in a white granitic rock on the Alisal Ranch (see Introduction). A tunnel was run in 125 feet, at which point a winze was sunk about 50 feet and it was in this winze that the ore was found. As near as can be learned, this tunnel and winze were dug more than 100 years ago by three Chileans, under the supervision of the Spanish padres. According to tradition, they erected a small furnace for smelting near the property, but after getting out considerable ore two of them went to the New Almaden mines to get an assay made and never returned.

Bibl: State Mineralogist's Report XV, p. 615. Cal. Sen. Doc. No. 9, 1854, by J. B. Trask, p. 18.

STRUCTURAL STONE.

Deposits of sandstone and other rocks suitable for building purposes have been only superficially developed. A belt of sandstone runs along the east slope of the Santa Lucia Range from T. 21 S., R. 7 E., in a

northwesterly direction past Tassajara Springs to T. 19 S., R. 3 E. It was quarried near the springs and used in the construction of the hotel. Bibl: State Mineralogist's Report XIII, p. 636; Bull. No. 38, p. 131.

Meadows Gulch Deposit. A deposit of light-colored, fine-grained siliceous shale rock, which is easily split into slabs from 1 inch to 3 or 4 inches or more in thickness, is being mined by Albert Otey, Box 263, Carmel, California. The material, locally called chalk rock, occurs in ledges, 3 to 4 feet wide on both sides of Meadows Gulch, which opens into Carmel Valley, on the James Meadows tract, about 10 miles southeast of Carmel. The stone is soft when mined and easily shaped and split, but hardens on exposure. Surface dirt is removed and the stone quarried by hand and sledded down the mountain to trucks which haul it to Monterey for rail shipment, or direct to destination. It is used mainly as a veneering for residences, in fireplaces and as flagstones. Production began in 1921. It has been used in San Jose, Palo Alto, and Berkeley, as well as locally.

Mr. Otey also produces sand from property which he owns at the mouth of Carmel River. The sand is shoveled direct to trucks which are backed down a prepared road. The river sand is said to be better suited for plastering than sand taken from salt water beach deposits.

A deposit of decomposed, coarse granitic rock on the Hatton Ranch, about 1 mile up Carmel Valley from Carmel, is also being quarried by Mr. Otey, for use on walks, roads and driveways in the vicinity of Carmel.

TILE.

Monterey Mission Tile Co. Henry L. Watson, president; T. H. Bane, secretary; home office, Monterey, California. This company started the manufacture of hand-made roof and floor tile at their plant on Mesa road, ‡ mile from the railroad station at Monterey, in July, 1924. Local clays, obtained from various points within a radius of 10 miles of Monterey, are used at present. The clay is worked up to a smooth, plastic mass on a platform by shoveling and treading with the bare feet. The tiles are hand molded, stacked for air drying and then burned in an open top up-draft oil-fired kiln. The daily capacity of the plant is 200 square feet of tile. The average number of men employed is six. The installation in the near future of mixing machinery and other mechanical equipment is contemplated.

LOS ANGELES FIELD DIVISION

W. BURLING TUCKER, Mining Engineer.

ORANGE COUNTY.

GENERAL DESCRIPTION.

Orange County is bounded on the east by Riverside County, north by San Bernardino and Los Angeles counties, west by Los Angeles County and the Pacific Ocean, and on the south by San Diego County. It comprises 795 square miles, about three-fifths of this area being valley land and the remaining two-fifths mountainous and foothill land.

The Santa Ana Range of mountains is the line between Orange and San Bernardino counties, at the northeast corner of the former county. It is also the dividing line between Orange and San Diego and Riverside counties. This range also sends up a line of foothills westwardly along the seashore nearly half way across the county. All the western portion of the county is included in the Santa Ana Valley. The highest point of land has an elevation of 5675 feet above the sea level, and is known as Santa Ana Peak.

PRINCIPAL STREAMS.

The Santa Ana River comes into the county near the northeast corner and continues through it in a southwesterly direction, flowing into Newport Bay. Santiago Creek has its rise in the Santa Ana Range of mountains, and flows in a northerly and westerly direction, emptying into the Santa Ana River about two miles northwest of the city of Santa Ana. Aliso Creek has its rise in the same range, but on the southern slope of the mountains, and runs in a southwesterly direction, flowing into the ocean near Arch Beach, about twenty miles southeast of the mouth of the Santa Ana River. Trabuco, Mission Viejo, and San Juan Creeks have their rise on the south side of the Santa Ana Range and come together near the sea, reaching the ocean at 'San Juan-by-the-Sea.' Coyote Creek marks the boundary of the county on the west.

GENERAL GEOLOGY.

The formation of the region consists of a base of granitic and metamorphic rocks overlain by Cretaceous, Tertiary, and Pleistocene sediments.

The main portion of the Santa Ana mountains is composed of ancient crystalline rocks, mostly slates of Jurassic age; along the western and southern flanks, rocks of Chico age are exposed, which in turn are overlain by small patches of the Eocene. In the Laguna hills the formations exposed are mainly coarse sandstone of Eocene age. These are overlain along the edges of the hills by beds of standstone and shale of the Monterey series. In the flat area running from Tustin to El Toro the diatomaceous shale of the Monterey series is present, occupying a synclinal trough between the Santa Ana mountains and the Laguna hills. This condition continues southeast through the Capistrano district to the San Diego County line.

For detailed Geology of Orange County the reader is referred to the reports by Bowers¹ and Fairbanks² in two of the earlier State Mineralogist Reports.

MINERAL RESOURCES.

Orange County stood third on the list of mineral producing counties of California for the year 1923, due mainly to its petroleum production. Other items yielded in commercial quantities are: Clay products, natural gas, gold, lead, silver, and miscellaneous stone.

Aside from the substances actually produced, Orange County is well supplied with such valuable minerals as coal, gypsum, iron, infusorial

earth, sandstone and tourmaline.

METALS.

GOLD.

Gold has been found at a number of points in the Santa Ana Range. The gold placer deposits of Lucas Canyon, a tributary to San Juan Canyon, located northeast of San Juan Capistrano, have been worked in a small way since the early days of the Spanish priests. At present writing Joaquin and Tomas Serano of El Toro are operating in the Canyon. Auriferous quartz veins have been discovered in Ladd and Trabuco Canyons, and a number of properties developed to some extent, although there has been no commercial production to date. The principal gold production in the county was made from 1889 to 1900.

MINES.

Santa Ana Mines comprise a group of 34 claims located in Trabuco Canyon, 14 miles east of El Toro. Elevation 2500 feet. Owners, Santa Ana Mining Company; Gail Borden, president; L. C. Comer, secretary. Offices, 506 Byrne Bldg., Los Angeles.

This property was originally located as a tin mine, but no ores containing tin were discovered. The formation is black carbonized slate. It is stated that the quartz stringers cutting the slate carry values in

gold.

Development: Consists of two crosscut tunnels; one located on the north side of the canyon is 300 feet, and about a quarter of a mile down the canyon on the south side is another tunnel 150 feet in length.

Equipment: One 9" x 15" Blake crusher, ten stamps, two Challenge ore feeders, 12-compartment settling tank, and four 4' x 8' agitators. Idle

Williams Minc. The mine is located in Ladd Canyon in T. 5 S., R. 7 W., 18 miles east of Orange. Owner, J. Goodby of Los Angeles.

The country rock is porphyry and slate. The vein strikes north and south and is from 12 inches to 2 feet in width. A crosscut tunnel was driven west 100 feet to intersect the vein. Workings caved. Idle.

¹ Bowers, Stephen, Orange County: State Mineralogist Report X, pp. 399-409, 1890. ² Fairbanks, H. W., Geology of San Diego County; also portions of Orange and San Bernardino counties: State Mineralogist Report XI, pp. 113-118, 1893.

ORANGE COUNTY-TABLE OF

Year	Petro	leum ·	Natural gas	Brick		
	Barrels	Value	Value	М.	Value	
889						
890						
892						
894						
895						
897	12,000	\$12,000				
898	60,000	60,000		300	\$2,400	
899	108,077	108,077		200	1,600	
					_,,	
900	254,397	254.397				
901	302,652	181,591				
902	1.103,793	824,492				
903	1,355,104	1,016,285		1,634	13,000	
904	1,470,000	1,144,542		1,500	9,000 11,800	
906	1,510,900 2,388,000	711,633 1,194,000		$\frac{118}{1,365}$	13.500	
				· ·	.,	
907	2,426,750	1,456,050		3,176	26,000	
908	3,376,689	2,532,517		4,050	20,450	
909	4,270,967	2,690,709		4,090	20,650	
910	5,044,001	3,177,721		2,950	31,000	
911	6,345,275	4,097,980		1,650	11,550	
912	6,704,421	4,478,553	\$5,250	1,300	9,100	
913	9,485,362	6,867,402	9,612	2,100	14,000	
914	12,758,678	8,612,108	112,040	1,333	19,300	
915	12,715,457	6,510,314	81,753	1,280	16,000	
916	13,198,591	8,750,666	139,281	1,186	8,300	
917	14,680,801	14,724,843	490,511	and tile	11,000	
918	15,730,462	22,211,412	693,169	477	3,869	
919	14,458,722	26,893,223	837,439	2		
000	15 400 741	22.050.240	969 442	2		
920	15,462,741	33,059,340	862,446	2		
921	22,929,466	45,996,509	1,312,704	2,994	47,720	
922	31,049,491	36,483,162	2,096,629	4,706	73,106	
923	46,474,921	40,897,930	3,914,661	8,499	103,428	
Totals	245,677,718	\$274,947,456	\$10,555,495	44,908	\$466,773	

¹Includes crushed rock, rubble, rip-rap sand, gravel, ²See under 'Unapportioned.'

INERAL PRODUCTION, 1889-1923.

Cla	Clay			Miscellaneous Minerals			
Tons	Value	industry ¹ value	Amount	Value	Kind		
			1,500 tons { 900 tons	\$6,262 10,943 9,470 6,000 4,000 144	Gold. Gold. Gold. Coal. Coal. Gold.		
			800 tons 600 tons 25 tons 240 cu. ft. 500 tons 300 tons	3,200 2,400 250 120 2,407 2,250 1,500	Coal. Coal. Gypsum. Sandstone. Gold. Coal.		
10,500 7,740	\$14,581 12,900		408 cu. ft. 500 cu. ft.	4,000 250 150 200 250	Gold. Gold. Gold. Sandstone. Sandstone.		
		22.005	964 lbs. 24,472 lbs. 33,546 lbs.	193 1,303 2,000	Copper, Lead. Zinc.		
9,000 2,617 500 2,000	18,600 26,170 5,000 3,200	\$3,005 23,665 6,443 855	14,405 lbs.	72,586	Lead. Unapportioned, 1900-1909.		
2,100 15,500	3,400 20,666	21,248 36,815 88,315	459 tons	688	Glass sand.		
2		9,027 3,773 2,699	{ 364 lbs. 4 lbs.	$\begin{array}{c} 17 \\ 1 \\ 3,066 \\ 2,573 \end{array}$	Lead. Copper. Other minerals. Pottery clay, copper, lead.		
3,649	4,650	1,560 1,944	{	18,499 97,632 84	Clay and clay products. Lead and potash. Copper. Gold.		
2		80,988	{ 15,932 lbs.	145 $1,275$ $7,263$ $96,595$	Lead. Silver. Brick, clay, potash.		
		131,301 270,022 536,767		10,796 3,168 16,203	Pottery clay, copper, gold, lead and silver. Clay (pottery), gold, lead and silver. Clay (pottery), copper, gold, lead and lsilver.		
253,606	\$127,656	\$1,218,427		\$369,918			



Portal of main tunnel, Yaeger Mines, Trabuco Canyon, Orange County.

Yaeger Mines (Quartz). Comprise a group of 15 claims located in Secs. 2, and 3, T. 6 S., R. 6 W., at the head of Trabuco Canyon, on the southwest slope of the Santa Ana Range of mountains, 17 miles east of El Toro. Owner, Jacob Yaeger, Fullerton. Elevation 3000 feet.

The country rock is granite, quartzite, and slate. The veins occur in granite and slate along fault zones. Four parallel veins which have a strike of N. 30° W., and a dip of 60° N.E. have been developed. These appear to be mineralized zones following faults. In width the veins vary from 12 inches to 10 feet. The ore developed carries gold, silver, lead, and zinc, some copper, and considerable pyrite.

Development: Consists of over 3000 feet of tunnels. The main working tunnel starts on the Julian Claim and is driven 1800 feet S. 60° W., intersecting three veins. It is stated that samples cut in the neighborhood of these three veins assayed from \$7.00 to \$20.00 per ton in gold and silver. Six other tunnels driven on the different claims have lengths varying from 65 to 550 feet.

Equipment: Blacksmith shop, assay office, and old mill consisting of No. 3 Dodge crusher, rolls and Frue vanner. Two men employed.

QUICKSILVER.

The occurrence of cinnabar is mentioned in Report XI of the State Mineralogist, page 118, as being found in an outlying hill of Tertiary sandstone known as Red Hill, 2 miles east of Tustin. The sandstone dips north at a small angle and consists of a loose aggregate of quartz grains cemented by a kaolinitic material. On the north side of the hill are a number of veins of heavy spar (barite) striking east and dipping south. These veins are not over a few inches wide and carry in a few places the steel-colored mercury which on its surface presents a reddish tinge. Several tunnels were driven into the hill, but failed to develop any ore.

Ores containing lead, silver, and zine occur on the west slope of the Santa Ana mountains. The mineral belt is two miles wide, and

extends from the Morrow Group of mines, located in Santiago Canyon, north to the Blue Light mine in Silverado Canyon, a distance of

eight miles.

The most important mines that have been developed to any extent are the Old Dominion, Morrow, and Blue Light. The country is formed, to a great extent, of dikes of greenish to blackish rocks, often showing distinct hornblende crystals. The mines south of Silverado Canyon are in a feldspathic rock which is probably an intrusive porphyry. The crystalline rocks of this region are of Cretaceous age.

Blue Light Mine. This property, formerly known as the Silverado Mine, is located in Silverado Canyon, 20 miles east of Orange, in Secs. 11 and 14, T. 5 S., R. 7 W.; elevation 2650 to 2950 feet. Owner, Blue Light Silver Mines Company; Charles Egabroad, president; C. S. Chapman, vice-president and managing director; S. L. Collins, secretary; O. H. Pembert, superintendent. Offices, F. & M. Building, Fullerton. Holdings comprise 13 claims consisting of 269 acres, 60

acres of which is patented.

Two parallel lodes known as Blue Light lode and Dike vein occur in the metamorphic rocks. The former having proved the most productive, has been extensively developed along its outcrop for a considerable distance. The veins have widths of 2 to 6 feet. The ore is silver-bearing galena, associated with zincblende and pyrite. Irregular lenses of complex lead-zinc sulphide ore occur in these two lodes. Seven known ore bodies have been developed on the Blue Light lode, in the north and south workings from No. 3 tunnel on the Blue Light claim. The Blue Light vein strikes N. 16° E., dips 30° to the east, and has been proved on the surface for a distance of 4500 feet. The average width of the vein is 4 feet. The vein has been developed by seven tunnels. At an elevation of 3000 feet No. 2 tunnel is driven on the vein 350 feet. No. 3 tunnel, which is 50 feet below No. 2 tunnel, is a crosscut for 200 feet to the vein, and then a drift for 470 feet south on the vein. This tunnel is connected by raises and stopes with No. 2 tunnel workings.

The most recent development has been in driving No. 7 tunnel, which is located north of No. 3 tunnel workings, and at a vertical elevation of about 400 feet below No. 3 workings in Pine Canyon. The tunnel is driven 50 feet southwest, then as a crosscut 110 feet east to the vein, with a drift south 800 feet on the vein, with the expectation of developing the known ore shoots worked in the upper levels. It is reported that 8000 tons of ore have been developed above No. 3 tunnel level, and that this ore has an average value of 0.06 oz. gold, 25 oz.

silver, 4% lead, and 13% zinc.

Equipment: One 14"x8"x8" Clayton compressor driven by semi-Deisel Y-type Fairbanks-Morse gas engine, air drills, blacksmith shop,

assay office, cars, and track.

Mill: A 50-ton flotation plant, two 9"x15" Blake-type jaw crushers, driven by 30-h.p. West Coast gas engine, Challenge ore feeder, 5'x4' ball mill in closed circuit with Dorr classifier, one 12' K & K flotation machine, two 6' K & K flotation machines, 1 Wilfley, 1 Overstrom, and 1 Cottrell table, two Dorr thickeners, and 1 Denver filter. The flotation plant is driven by 100-h.p. Fairbanks-Morse semi-Deisel gas engine.

In 1907 the mine produced 38,877 pounds of lead and 33,546 pounds of zinc; in 1920 it produced 15,932 pounds of lead; and in 1922 it

produced 81,400 pounds of lead concentrates.

Due to the complex character of the ore, the treatment of the ore by flotation methods has not proved successful as the lead and zine sulphides are very finely associated. The lead concentrates produced

carried as high as 14 to 30% zinc.

Ernst Harms and John Ellingham of Anaheim have installed a small plant at Anaheim and have contracted with the company to treat its ores by the hydrometallurgical process. Tests are being conducted at present and if the process proves successful in the treatment of the complex lead-zinc ores of the mine, this property may become an important producer. The company plans to continue development work on No. 7 tunnel level. Ten men are employed.

Bibl: State Mineralogist Report XX, pp. 43-45.

Morrow Group of Mines (Lead-Silver). This property is located in Santiago Canyon, in T. 5 S., R. 6 W., 9 miles northeast of El Toro, and comprises five claims: Alma, Geneva, Modjeska, King Solomon, and King Tut. Elevation 2600 feet. Owner, W. S. Morrow of Orange. The country rock is diorite, quartzite, and slate.

The veins strike approximately north and dip about 35° to the east. The mineralized zone has a width of 10 feet, but the pay ore occurs as stringers and irregular lenses varying in width from 12 inches to

3 feet.

The ore is galena, zincblende, pyrite, and a little antimony. The sorted ore shipped is stated to carry 40 ozs, silver, 24% lead, and 10% zinc.

This property has been worked at intervals for thirty years. In 1896–1897 the property was operated by the Santiago Mining Company, but since that date it has been operated at intervals by different lessees.

Developments: On the Alma claim there are three tunnels, the main tunnel being 600 feet, and two crosscut tunnels 100 to 175 feet in length.

There are a number of tunnels on the other claims.

The ore was packed out over a trail 4 miles, then hauled to the railroad at El Toro. It is stated that the property has produced considerable lead ore carrying high values in silver. Idle.

Old Dominion Mine. (Lead-Silver, Zinc.) The mine is located at the head of Long Canyon, a tributary to San Juan Canyon in T. 6 S., R. 5 W., 6 miles west of Elsinore. Elevation 3400 feet. Owners, M. L. Cambern and A. Schneider of Elsinore.

NONMETALS.

CLAY.

On the west side of the Santa Ana range are deposits of clay which will probably be found to equal in geologic age and commercial properties the clays of Temescal Valley, Riverside County. The clay beds are quite variable in character, at different points containing white and red plastic clay, and gray and black flint fire clay.

Fire clay is reported in Hicks Canyon in the SE¹ of Sec. 2, T. 6 S., R. 7 W., S. B. M. Also in Bell Canyon in the NE part of Sec. 24, T. 6 S., R. 7 W. On the ranch of Louis Moulton, south of El Toro, on

Aliso Creek, there is a deposit of good bluish clay.

The low-grade clays used in the manufacture of red brick and red tile are fairly abundant in the county. On the ridge west of the Santa Ana River, south of Wintersburg, is found a deposit of good clay. The clay in the ridge has been opened up on Sec. 35, T. 5 S., R. 11 W., S. B. M., on both sides of the branch line of the Southern Pacific Railroad from Newport to Smeltzer. The clay is very compact, of a dark gray color, in places tinted slightly red by iron oxide.

PLANTS.

Garber Brick & Tile Company; H. Garber, president. The company control six acres, one-half mile east of Olive. The plant manufactures common brick, hand-made roofing tile, and floor tile, also roof dressing material, and a dust product for molding sand. Material is transported from clay pit by drag-line scraper to plant, where it passes through rolls, is then elevated to storage bins, then to the clay mixer and to the brick press. The bricks are then conveyed over a cable conveyor to drying racks, and are then burned in field kilns. Roofing and floor tile are made by hand. Oil and natural gas are used as fuel.

Equipment: Consists of a 30-h.p. boiler, Ingersoll-Rand compressor, Blake type of crusher, screens, elevators for crushing rejects for roof

dressing and molding sand. Ten to twenty men are employed.



Plant of the La Bolsa Tile Company, Weibling, Orange County.

La Bolsa Tile Company; George W. Moore, president; A. W. Griffith, secretary; E. R. Bradbury, superintendent. Offices, Huntington Beach. The plant is located two miles north of Huntington Beach at Wiebling Siding on the Southern Pacific Railroad. The company owns 31 acres located in Sec. 35, T. 5 S., R. 11 W., S. B. M. They manfacture drain tile from 3 to 20 inches in diameter, hollow building blocks, and common brick.

The capacity of its plant is about 25,000 linear feet of tile per month, and is equipped with 90-h.p. gas engine and a 70-h.p. boiler. Ten men are employed.

The clay from the pit is hauled by Fordson tractor to a hopper, from which it passes to the dry pan crusher; it is then conveyed by a vertical elevator into the hopper, which discharges the ground material into a short pugmill from which it passes into a lower pugmill provided with an auger which forces the clay through the die upon the wire cutting table. The tiles up to 8 inches in diameter are cut to the length of 13 inches, those of larger diameter to that of 271 inches. There is also one steam press machine for tile of 10, 12, 18, and 20-inch diameter. The drying sheds are heated by hot air forced by blower through flues under the floor. This hot air is obtained either from exhaust of the kilns or by forcing air through a coil stove heated by exhaust steam from the boiler. The drying sheds have a storage capacity of 60,000 tile. The smaller-sized tile are dried in 24 hours or more; the larger tile require 60 hours. The plant is equipped with three 28-foot and one 32-foot down-draft kilns, using oil and natural gas as fuel, having one main flue and one stack.

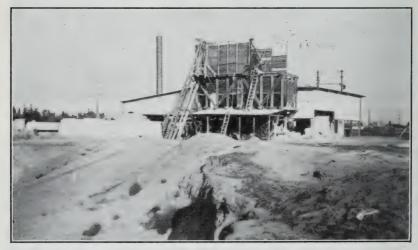
Los Angeles Pressed Brick Company owns and operates an important deposit of fire clay of high quality lying a few miles south of the Santa Ana River.

The clay is a black flint fire clay which shows a thickness of about 20 feet, and is overlain by about 10 feet of blue clay and some reddish-colored plastic clay.

The material is hauled to Gypsum Station on the Santa Fe Railroad, and shipped to the company plant located in Los Angeles.

Orange County Brick and Tile Company: F. C. Krause, president; Charles Page, secretary; W. J. Carmichael, general manager. The company owns nine acres in Sec. 9, T. 4 S., R. 10 W., within the city limits of Anaheim.

The company is manufacturing building brick, and also produces sand for building purposes. The material used is unconsolidated sand. The sand is mixed with lime and cement in the following proportions:



Plant of the Orange County Brick and Tile Company, Anaheim, Orange County,

Common brick: lime $7\frac{1}{2}\%$, cement 2%. Face Brick: lime 10%, cement 5%.

Material from the sand pit is transported by drag-line scraper to a hopper, from which it goes to a bucket elevator, elevated and then passed through a revolving screen. Here it is sized into three different sizes; the over-size and the minus 8-mesh going to storage bins, the fine sand to wet grinding pan, where it is ground and then elevated to two bins, then sent on to the mixer from which it is fed to two American clay brick rotary presses. One press has a capacity of 8000 brick, the other 17,000 brick. The brick then are loaded onto cars and given 10-hour heat treatment under 125 pounds pressure in two Hardinge cylinder dryers. These dryers are 80 feet long by 6 feet in diameter. Heat for cylinder dryers is furnished by 70-h.p. boiler, oil being used as fuel. The other equipment is driven by electric motors. Ten men are employed.

COAL.

During the period extending from 1888 to 1892 there was considerable activity in the development of the coal deposits of Orange County and some production made which was used locally. There were three coal mines located in a series of clay shales and sandstone of Cretaceous age. These are on the east side of Santiago Creek. This belt containing seams of coal extends northeast from Silverado Canyon for a distance of about five miles. The properties are briefly mentioned by Bowers ¹ and by Fairbanks.² These properties were known as the Black Star, Santiago or Santa Clara, and Harris Mines.

The latest development on the coal deposits was during 1914 and 1915 by the Orange County Coal Mining Company of Santa Ana, on

the Santiago Coal Mine.

The Santiago Coal Mine is located 9 miles east of Orange in T. 4 S., R. 8 W., S.B.M., east of Santiago Creek. Elevation 1100 feet. Holdings comprise 100 acres of patented ground owned by Mrs. S. M. Craddick of Orange. The above mentioned company sunk an incline shaft on a seam of coal to a depth of 255 feet. At a depth of 189 feet a drift was run east along a fault for a distance of 200 feet. The seam of coal developed varied in width from 10 inches to 3 feet. The production was small, being used locally for domestic and other purposes. The Orange County Coal Company suspended operations in 1915, and no further development has been attempted since that date.

GYPSUM.

Gypsum Canyon Deposit. A deposit of gypsum occurs in Gypsum Canyon, on the west slope of the Santa Ana mountains, five miles south of Corona. It is in the form of a bunchy vein in rocks of probably Upper Cretaceous age. The strata are chiefly sandstone. The deposit has a thickness of 8 to 10 feet. The gypsum is white and crystalline and is almost as clear as alabaster. At one spot a mass of dolomite was found inclosed in it. The deposit is so situated as to be in easy reach of the valley lands where it has been used to some extent for land fertilizer. It has been found that gypsum has great value in neutralizing the alkalies present in large quantities in some of the valley lands of the State.

Bibl.: U. S. Geol. Survey Bulletin 223, pp. 120-121.

Bowers, Stephen, State Mineralogist Report X, p. 403, 1890.
 Fairbanks, H. W., State Mineralogist Report XI, pp. 113-114, 1893.

LIMESTONE.

Capistrano. A deposit of fossiliferous limestone is located in Sec. 31, T. 7 S., R. 7 W., S.B.M., one mile north of San Juan Capistrano. R. Egan of San Juan Capistrano, owner.

The limestone was formerly burned for lime by the padres for the

building of the San Juan Capistrano Mission.

Ladd Canyon. A deposit of grayish-black crystalline limestone is located along the slopes of the West Fork of Ladd Canyon, 20 miles east of Santa Ana. Elevation 2200-2900 feet. Ten claims have been located in Secs. 3, 4, and 33, T. 4 S., R. 7 W., S.B.M., by Leo Kroonen of Corona. The deposit where it is exposed by the canyon is about 400 feet thick. Analysis of the limestone made by Frederick W. Huber of the University of California is as follows:

	Per cent
Silica (Si O_2)	
Lime (CaO)	51.45
Iron and alumina $(Fe_2 O_3 \& Al_2 O_3)$	1.95
Magnesia (MgO)	1.86
Ignition loss (H ₂ O)	43.08
Undetermined	0.32
Total	.100.00

The limestone is reported to be suitable for the manufacture of cement.

El Toro. Extensive beds of fossiliferous limestone are found on the William L. Moulton Ranch, 3½ miles south of El Toro. The deposit

has been under lease to the Marine Shell Fertilizer Company.

A crushing plant was installed in 1922, and operated during 1923, and the crushed limestone sold locally for soil fertilizer. The material from opencut was transported in cars and dumped into an incline chute, passing through a No. 4 Wheeling jaw crusher, which was driven by 25-h.p. Fairbanks-Morse gas engine. The crushed material from No. 4 crusher is conveyed over a belt conveyor to a No. 2 Wheeling crusher. The material from this crusher passes onto a 24-inch belt conveyor to a shaking screen, where it is screened to 8 mesh, oversize from screen going to Williams rolls. The minus 8-mesh material is elevated by bucket elevator to storage bins. The plant is driven by a 50-h.p. gas engine.

The following analysis of this limestone is reported: Calcium carbonate 96%; silica 2.5%; alumina 1%; iron oxide 0.5%. The plant

is idle at present.

PETROLEUM and NATURAL GAS.

Orange County production of petroleum for the year 1923 amounted to 46,474,921 barrels valued at \$40,897,930. In addition to this, natural gas was reported as valued at \$3,914,661. The principal productive oil fields of the county are: Brea-Olinda, Coyote Hills, Huntington Beach, Newport, and Richfield. For detailed description of the different oil fields of the county see Bulletin No. 69, 'Petroleum Industry of California,' and Bulletin 89, 'Petroleum Resources of California'; also State Oil and Gas Supervisor's Annual Reports.

Bibl: Bulletin 19, pp. 57-61, 79-82, 177-180; Bulletin 32, p. 20; Bulletin 63, p. 334; Bulletin 69, pp. 118, 308, 350, 366, 503;

Bulletin 89, pp. 136-139; State Oil and Gas Supervisor's Annual Reports, Vol. I, pp. 173-176, 180-181; Vol. II, pp. 129-146; Vol. VII, No. 5; Vol. VIII, No. 9; Vol. IX, No. 6.

STONE INDUSTRY.

The rapid growth of the cities and towns of Orange County has caused an increased demand for building materials, especially crushed rock, sand, and gravel. A number of gravel plants are under operation on Santiago Creek near Orange; there is also a number of sand plants on the Santa Ana River. The materials are used for the construction of buildings, concrete, and road work.

CRUSHED ROCK, SAND, and GRAVEL PLANTS.

Bixby Pit. A crushing plant operated by Orange County is located one mile east of Olive on the Bixby ranch. The material handled is a decomposed granite and is used on the roads of the county. The

capacity of the plant is 350 yards per day.

The material from opencut is transported by drag-line scraper to a hopper, from which it passes through a revolving screen with 1½-inch perforations. The through-size material is elevated by bucket elevator to storage bins, and the over-size goes to 10-inch x 20-inch Blake type crusher. From the crusher it is fed to a revolving screen with 1-inch perforations, the over-size going to 9-inch x 15-inch Blake type crusher, through-size going to receiving bins. The plant is driven by motors, two crushers being driven by two 20-horsepower gas engines. Six men are employed.



Rock Crushing Plant, Orange County Rock Company, Orange,

Orange County Rock Company, Inc. A. G. Wright president; O. W. Bachman, secretary, Orange. The crushing plant is located on Santiago Creek near North Prospect and McPherson Streets, within the city limits of Orange. The capacity of the plant is 2500 tons daily.

The gravel from Santiago Creek is loaded into a train of three cars having a capacity of four yards each, by a Marion gas-electric shovel.

The cars are hauled by a Plymouth gasoline motor to storage bins where the gravel is dumped over a grizzly, the bars being spaced ten inches apart. All boulders that will not pass the grizzly are stored in the vard. From receiving bins, the 10-inch and finer gravel goes to a No. 5 Blake type jaw crusher, then to 42-inch belt conveyor, which conveys the material to a revolving grizzly, where the rock is screened to 21-inch. The oversize goes to a Telsmith crusher, where it is reduced to two inches. This sized material is carried in a bucket elevator to a dry screening plant, and all material over 11 inches is returned to a Weston crusher, where it is crushed to one-inch size. It is then elevated by a bucket elevator and returned to a dry screening plant, where it is screened by Gilbert revolving screens, producing the following sizes: 15-inch, 1-inch, 1-inch, 1/16-inch, and dust, which drop into their respective compartments in the storage bins. The minus 24-inch material from the revolving grizzly is conveyed by 22-inch belt conveyor to washing plant, where it is sized by Gilbert system of revolving screens, making the following products: 2-inch, 13-inch 1-inch, 3-inch to 1/16 inch, and sand. The sand goes to two 12-inch log washers. The sand is deposited in bunkers and also in ground storage in the vard. The capacity of storage bunkers for products is 800 yards. Railroad cars and trucks are loaded, according to specifications, by a 22-inch belt conveyor through gates from each bin.

Electric power is used to operate the plant, the total capacity being

386 horsepower.

The company owns and has under lease 286 acres along Santiago Creek. The plant is the largest rock and gravel plant in Orange County. The cost of operation varies from 50 to 75 cents per yard. Twenty men are employed.

Santa Ana Rock and Gravel Company. R. S. King, president; M. M. Ford, secretary. Offices, 211 West First Street, Santa Ana. The plant is located on Santiago Creek, near South Shaffer Street, Orange. The company owns 21 acres along Santiago Creek. The capacity of the

plant is 250 yards per day.

The gravel from the creek bed is loaded into Western dump cars by a Northwest Engineering Company gasoline-driven shovel. The cars have a capacity of $1\frac{1}{2}$ yards. Two trains of two cars are hauled by Fordson motors to the plant where the gravel is dumped onto a grizzly, the bars being spaced eight inches apart. From the grizzly the gravel passes to a hopper. It is then elevated by bucket elevator to the washing plant and passed through a revolving screen where it is screened to the following sizes: $2\frac{1}{2}$ ", 1", and $\frac{1}{4}$ ". The over-size from the revolving screen goes to a No. 8 Fort Wayne crusher, the crushed material returning to the screen, the 2" material to the stock pile, 1" and $\frac{1}{4}$ " rock to receiving bin, and sand of from $\frac{1}{4}$ " to $\frac{1}{8}$ " to the bin. A 25-h.p. motor drives the rock breaker and screen; and a 5-h.p. motor drives the belt conveyor. Twelve men are employed.

Yaeger Rock Company. William F. Yaeger, president; Lillian Yaeger, secretary. Offices, 410 N. Spadra Street, Fullerton. The plant is located on Santiago Creek, one mile southeast of Orange. The company owns 23 acres along Santiago Creek. Capacity of the plant is 300 yards per day.



View of shovel in gravel pit, Yaeger Rock Company, Orange.

The gravel is loaded by a Northwest Engineering Company gasoline-driven shovel into two 2-ton cars which are hauled by gasoline motor to the plant. The material is dumped into a receiving hopper from which the gravel is elevated by bucket elevator to a revolving screen, where it is graded to the following products: 2", 1", \frac{1}{4}". The fine material from the trommel goes to an 8-mesh revolving sand screen. The over-size from this screen is returned to a No. 4 Telsmith gyratory crusher. The crushed product from the gyratory is elevated to the washing plant and is then returned to the revolving screen. Four products are produced. The gyratory crusher is driven by a 30-h.p. motor. A 50-h.p. motor drives the trommels and conveyors. Eight men are employed.

W. Brady, R. D. 2, Orange, is operating a gravel pit on Santiago Creek.

SAND.

The following operators were producers of sand for building purposes:

Cunningham & Son, Garden Grove, are operating a screening plant on the Santa Ana River, northeast of Garden Grove.

Garden Grove Sand & Gravel Company, 205 E. First Street, Long Beach, are operating a screening plant on the Santa Ana River, two miles northeast of Garden Grove.

La Habra Sand & Gravel Company, 312 E. Santa Fe Street, Fullerton, were producers during the year 1924.

Lindauer & Sons, 200 W. Central Avenue, La Habra, were producers during the year 1924.

R. P. Mitchell of Garden Grove owns a screening plant near the Santa Ana River, three miles northeast of Garden Grove.

Sparks & McClelland, 312 W. Center Street, Anaheim, are operating two screening plants on the Santa Ana River, two miles east of Olive.

J. O. Swartzbaugh, R. D. 2, Box 45, Orange, operates two screening plants located on the Santa Ana River, three miles southeast of Anaheim.

OIL FIELD DEVELOPMENT OPERATIONS.

By R. D. Bush, State Oil and Gas Supervisor.

From October 5, 1924, to and including January 24, 1925, the following new wells were reported as ready to drill:

Company	Sec.	Twp.	Range	Well No.	Field
RESNO COUNTY:					
Premier Oil Co.	24	20	14	28	Coalinga
C. J. Howell	25	14	19	1	Fresno County
ERN COUNTY:					
Bear State Oil Co.	30	28	21	13	Belridge
Belridge Oil Co.	34	30	24	7	Elk Hills
Belridge Oil Co. Pacific Oil Co.	35	30	24	5	Elk Hills Elk Hills
racine on co.	35	30	24	89	Elk Hills
Pacific Oil Co.	35	30	24	108	Elk Hills
Pacific Oil Co.	35	30	24	110	Elk Hills
Pan American Petroleum Co.	$\frac{1}{6}$	31	24 25	Crampton 3-I	Elk Hills Elk Hills
Pan American Petroleum Co Petroleum Producers, Inc	14	31	24	Crampton 4-B	Elk Hills
Standard Oil Co.	31	30	25	Kern Co. 20	Elk Hills
Standard Oil Co.	36	30	24	Tupman 43	Elk Hills
C. S. Akers East Puente Oil Co. Kern River Oilfields of California.	34	27	27	1	Kern River Kern River Kern River
East Puente Oil Co.	4	29	28	1-A	Kern River
Kern River Oilfields of California	33	28	28	1-AA	Kern River
Marland Oil Co Section Five Oil Co	16 9	28 29	27 28	Cauley 2 7-A	Kern River Kern River
H. R. Wiseman	26	28	28	Faith 2	Kern River
Universal Consolidated Oil Co.	32	26	21	44	Lost Hills
Berry & Keller	13	30	21	8-A	McKittrick
J. F. McMahon	29	30	22	3	McKittrick
Northern Counties Oil Co. Washington Petroleum Corp.	18	30	22	1	McKittrick
Washington Petroleum Corp.	$\frac{8}{24}$	30 31	22 23	3 44	McKittrick Midway
Balboa Oil Co.	35	32	23		Midway
Bell Evans Oil Co., Inc. Berry & Ewing Big Ten Oil Co. Brookshire Oil Co.	31	32	24	7 5	Midway
Big Ten Oil Co.	36	32	23	6	Midway
Brookshire Oil Co	24	31	22	14	Midway
Brooksnire Oil Co	24	31	22	15	Midway
C. C. M. O. Co. Federal Drilling Co.	22 20	31	22 24	34	Midway Midway
Honolulu Consolidated Oil Co.	6	32	24	$\begin{array}{c} 1 \\ 25 \end{array}$	Midway
Honolulu Consolidated Oil Co.	6	32	24	26	Midway
Hanalulu Canaalidatad Oil Ca	6	32	24	27	Midway
Honolulu Consolidated Oil Co.	6	32	24	36	Midway
Honolulu Consolidated Oil Co.	6	32 32	24 24	46 47	Midway Midway
Honolulu Consolidated Oil Co. Honolulu Consolidated Oil Co.	6	32	24	64	Midway
Honolulu Consolidated Oil Co.	6	32	24	66	Midway
Honolulu Consolidated Oil Co.	6	32	24	77	Midway
Manley & McGinn	15	31	22	10	Midway
Marland Oil Co.	19	31	23	4	Midway
Midland Oilfields Co., Ltd. Midland Oilfields Co., Ltd.	24 24.	31	23 23	13 14	Midway Midway
Mocal Oil Co.	26	31	22	13	Midway
North American Oil Cons.	30	31	24	14	Midway
North American Oil Cons.	30	31	24	15	Midway
North American Oil Cons.	30	31	24	16	Midway
Pacific Oil Co.	19 35	31 32	24 24	9	Midway Midway
Pacific Oil Co	31	31	24	32	Midway
Pacific Oil Co.	5	32	24	47	Midway
Pacific Oil Co.	19	31	24	49	Midway
Pacific Oil Co.	29	31	24	49	Midway
Pacific Oil Co.	5	32	24	51	Midway Midway
Pacific Oil Co.	25 31	31	23 24	65 70	Midway
Pacific Oil Co.	31	31	24	236	Midway
Pacific Oil Co. Pyramid Oil Co. San Jose-Elk Hills Oil Co.	28	32	24	11	Midway
San Jose-Elk Hills Oil Co.	26	31	24	1	Midway
Surprise Oil Co. General Petroleum Corp.	36	32	23	10	Midway
General Petroleum Corp.	12	11	24	60-A	Sunset
General Petroleum Corp.	12	11	24 24	70-A 3	Sunset Sunset
J. W. Jameson Midway Northern Oil Co.	$\frac{2}{32}$	12	23	11	Sunset
Midway Oil Co	35	12	24	$\frac{11}{370}$	Sunset
Midway Oil Co. Obispo Oil Co. Pliocene Oil Co.	35	12	24 23	395	Sunset
Midway Oil Co.	32	12		9	Sunset

Company	Sec.	Twp.	Range	Well No.	Field
KERN COUNTY—Continued. St. Anthony Oil Co. Standard Oil Co. August J. Bomke Canal Oil Co. Wesco Petroleum Co. Crusaders Oil Co. George F. Getty, Inc. X. H. Grusenmeyer. Howland Oil Co. Modoc Petroleum Corp. Painted Hills Oil Assn. E. W. Spiers. Standard Oil Co.	10 36 36 1 2 12 36 36 21 22 12 2 10 19 31 5	11 12 12 11 11 11 29 29 29 10 11 11 29 27 31 32 10	24 24 24 24 24 20 20 20 20 23 23 28 28 22 22 22	M. J. M. & M. 56 M. J. M. & M. 57 Maricopa 27 Monarch 43 1 1 22 1 1 1 10 Mills-Kern 1 F-1 Kern Co. Lease 4	Sunset Sunset Sunset Sunset Sunset Temblor Temblor Temblor Kern County
Donald W. Whittier	5	11	24	Nichols Fried 1	Kern County
KINGS COUNTY: Chas. R. Blyth_ George W. Shearer	34 18	21 23	17 19	Blyth 1	Kings County Kings County
LOS ANGELES COUNTY: Fullerton Oil Co. Associated Oil Co. Henderson Petroleum Corp. Marland Oil Co. Shell Co. Union Oil Co.	2 34 34 33 34 34 34 34 34 34 34 34 34 34	3 3 3 4 4 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	10 13 13 13 13 13 13 13 13 13 13 13 13 13	DeFrancis 6 Susana 1 Dominguez 5 Dominguez 5 Dominguez 6 Manuel 1 Manuel 2 Manuel 3 Manuel 5 Reyes 19 Reyes 20 Reyes 21 Reyes 22 Reyes 23 Reyes 24 Reyes 25 Reyes 26 Virginia 1 Callender 8 Callender 8 Callender 9 Hellman 9 Hellman 1	Brea Olinda Dominguez
troleum Corp	3	4	13	Dominguez 3	Dominguez
United Oil Co. and Henderson Petroleum Corp	24 29 29 29 14 24 19 24 28 24 6 34 13 20 18 20 7 7 7	4 2 2 2 4 4 4 4 4 4 4 4 4 4 4 2 1 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	13 14 14 12 12 12 12 13 13 12 13 12 13 13 13 13 13 13 13 13 13 13 13 13 13	Dominguez 4 Baldwin 2 L. A. Inv. 1 3 McAllister 1 1 Hall Weber 3 2 Flower State 1 Los Cerritos 1 Butler 1 Dollarhide 1 B-5 O'Donnell 36 19 3 Wanka 2 O'Dea 3 Rosecrans 3 Rosecrans 3 Rosecrans 3 Rosecrans 4 Kanady 1 Kanady 1 Kanady 1 Athens 1 Athens 2	Dominguez Inglewood Inglewood Inglewood Long Beach Rosecrans

Company	Sec.	Twp.	Range	Well No.	Field
LOS ANGELES COUNTY—Cont.					
Marine Oil Corp. E. J. Afiley E. J. Miley E. J. Miley E. J. Miley	7	3	13	33	Rosecrans
E. J. Miley	7	3	13	Athens 3	Rosecrans
E. J. Miley	7 7	3	13 13	Athens 4	Rosecrans
E. J. Wiley	7	3 3	13	Athens 5 Athens 6	Rosecrans Rosecrans
E. J. Miley Mohawk Oil Co.	7	3	13	Bateman 1	Rosecrans
Mohawk Oil Co.	7	3	13	Brooks 1	Rosecrans
Mohawk Oil Co. Pacific Petroleum Corp.	7	3	13	Athens 3	Rosecrans
Pacific Petroleum Corp. Roy W. Perkins Petroleum Midway Co., Ltd Petrole	7	3	13	1	Rosecrans
Petroleum Midway Co., Ltd.	7	3	13	Baskin 1	Rosecrans
Petroleum Midway Co., Ltd.	7 7	3 3	13	Ducommun 1-A	Rosecrans
Petroleum Midway Co., Ltd.	7	3	13 13	Folsom 1 Fox Comm. 1	Rosecrans Rosecrans
Petroleum Midway Co., Ltd.	7	3	13	Kreitz Comm. 1	Rosecrans
Petroleum Midway Co., Ltd.	7	3	13	McCormick 1	Rosecrans
Sentinel Oil Co. Sentinel Oil Co.	7	3	13	Athens 2	Rosecrans
Sentinel Oil Co.	7	3	13	Athens 3	Rosecrans
Tidal Oil Co	20	3 3 3 3 3 3	13	1	Rosecrans
Union Oil Co.	18	3	13	Howard Park 7	Rosecrans
Union Oil Co.	18 18	3	13 13	Howard Park 8 Jamison 1	Rosecrans
Union Oil Co. General Petroleum Corp.	5	3	11	Santa Fe 45-A	Rosecrans Santa Fe Springs
Union Oil Co.	6	3	11	Alexander 9	Santa Fe Springs
C. C. M. O. Co	16	4	14	Del Amo 31	Torrance
C. C. M. O. Co	16	4	14	Del Amo 32	Torrance
C. C. M. O. Co	9	4	14	Del Amo 102	Torrance
C. C. M. O. Co.	15	4	14	Torrance 76	Torrance
C. C. M. O. Co.	15	4	14	Torrance 78	Torrance
C. C. M. O. Co.	$\frac{15}{30}$	4 4	14 13	Torrance 84	Torrance
Consolidated Mutual Oil Co Consolidated Mutual Oil Co	30	4	14	Empire 2 Oakley 60 1	Torrance Torrance
Fullerton Oil Co.	16	4	14	Cotton 9	Torrance
General Petroleum Corp.	30	4	13	20	Torrance
General Petroleum Corp.	8	4	14	Carson 5	Torrance
General Petroleum Corp.	25	4	14	Poggi 1	Torrance
General Petroleum Corp.	25	4	14	Poggi 2	Torrance
General Petroleum Corp.	25	4	14	Poggi 3	Torrance
General Petroleum Corp.	30	4	13	Poggi 4	Torrance
General Petroleum Corp.	30	4	13	Poggi 5	Torrance
George F. Getty, Inc.	8 25	4	14	Torrance 25	Torrance
Marine Oil Corp. Petroleum Midway Co., Ltd.	8	4 4	14 14	R. J. Brown 1	Torrance Torrance
Petroleum Midway Co., Ltd.	14	4	14	Carlson 4	Torrance
Petroleum Midway Co., Ltd.	8	4	14	Churchill 1	Torrance
Petroleum Midway Co., Ltd.	9	4	14	Craven Comm. 3	Torrance
Petroleum Securities Co.	19	4	13	Kleinmeyer 9-A	Torrance
Petroleum Securities Co.	19	4	13	Kleinmeyer 10-A	Torrance
Petroleum Securities Co.	19	4	13	Kleinmeyer 11-A	Torrance
Petroleum Securities Co.	19 24	4 4	13 14	Kleinmeyer 13-A Kleinmeyer 14-A	Torrance Torrance
Petroleum Securities Co	24	4	14	Kleinmeyer 32-A	Torrance
Petroleum Securities Co.	30	4	13	Kleinmeyer 17-B	Torrance
Petroleum Securities Co.	30	$\hat{4}$	13	Kleinmeyer 18-B	Torrance
Selby & Root Co.	14	4	14	10	Torrance
Selby & Root Co	9	4	14	2	Torrance
Shell Co.	24	4	14	Bluemle 6	Torrance
Shell Co.	9	4	14	Torrance 3	Torrance
Standard Oil Co.	13 16	4 4	14	Dominguez 14 Flint 2	Torrance Torrance
Standard Oil Co. Standard Oil Co.	25	4	14	Joughin 19	Torrance
Standard Oil Co.	25	4	14	Joughin 20	Torrance
Standard Oil Co.	24	4	14	Kettler 4	Torrance
Standard Oil Co.	15	4	14	Marble Fee 28	Torrance
Standard Oil Co.	15	4	14	Marble Fee 29	Torrance
Standard Oil Co.	15	4	14	Marble Fee 30	Torrance
Standard Oil Co.	15	4	14	Marble Fee 31	Torrance
Standard Oil Co.	15 16	4 4	14	Marble Fee 32 Marble Fee 33	Torrance Torrance
Standard Oil Co.	22	4	14	Marble Lease 2 2	Torrance
Standard Oil Co Standard Oil Co	16	4	14	Quandt 3	Torrance
Superior Oil Co.	19	4	13	Torrance 52	Torrance
Superior Oil Co.	24	4	14	Torrance 55	Torrance
Superior Oil Co.	25	4	14	Torrance 56	Torrance
Superior Oil Co.	30	4	13	Torrance 57	Torrance
Superior Oil Co. Central Oil Co. of Los Angeles	19	4	13	Torrance 58	Torrance
Central Oil Co. of Los Angeles	23	2	11	D: 1 M: 16-13 1	Whittier
A. W. Duncan	18	4	11	Bixby Midfield 1	Los Angeles Coun Los Angeles Coun
Chas. McFadden	17	3	14	Sentous 1	Los Angeles Coun Los Angeles Coun
Pan American Petroleum Co.	11	2	15	Sentous 1	Los Angeles Coun
J. J. Rekar	11	2 2 5	12	Bryant 2	Los Angeles Cour
Shell CoShell Co	1	5	12	Bryant 3	Los Angeles Coun
	27	2	9	1	Los Angeles Cour

tion may be true.					
Company	Sec.	Twp.	Range	Well No.	Field
NAPA COUNTY: John E. Callahan	19	8	3	Prospect 1	Napa County
J. H. Carter	29	8	3	Prospect 1	Napa County
ORANGE COUNTY:					
Standard Oil Co.	13 17	3 3	11 10	Emery 40	Coyote Hills
Standard Oil Co. Standard Oil Co.	19	3	10	M-C 101 M-C 102	Coyote Hills Coyote Hills
Associated Oil Co. Columbia Leasing & Development Co.	2 2	6	11	Wardlow 2	Huntington Beach
Pan American Petroleum Co.	11	6	11	Johnson 3	Huntington Beach Huntington Beach
Petroleum Midway Co., Ltd. Southern California Drilling Co.	11	6	11	Brown 5	Huntington Beach
Standard Oil Co	24	6 5	11	Riggle 2 Bolsa 19	Huntington Beach Huntington Beach
Standard Oil Co.	34	5 5	11	Bolsa 20	Huntington Beach
Standard Oil Co. Standard Oil Co. Standard Oil Co.	3	6	11	Huntington A 26 Huntington	Huntington Beach
				A 26-A	Huntington Beach
Standard Oil Co.	34	5 6	11	Huntington A 27	Huntington Beach
Standard Oil Co. Standard Oil Co. Standard Oil Co.	3	6	11	Huntington B 27 Huntington B 28	Huntington Beach Huntington Beach
Standard Oil Co.	4	6	11	Huntington B 28 Huntington B 29	Huntington Beach Huntington Beach
Standard Oil Co	19	6	11	Huntington E 9 Thomson 5	Huntington Beach Huntington Beach
Bruce Oil Co.	27	6	10	1	Newport
Bruce Oil Co. A. J. Delaney A. J. Delaney	29 29	6	10	2 3	Newport Newport
N. E. Guthrie Newport Petroleum Corp.	28	6	10	1	Newport
Newport Petroleum Corp.	27 28	6	10	Tunnel 1	Newport Newport
South Basin Oil Co. Alfred Violette John A. Yerkes	24	6	10	1	Newport
John A. Yerkes	28	6 3	10	Elmer 1	Newport
Chicksan Oil Co.	32 28	3	9 9	Thompson 6	Richfield Richfield
General Petroleum Corp. Petroleum Midway Co., Ltd. Standard Oil Co. Calny Oil Co.	33	3 3	9	9	Richfield
Standard Oil Co.	32	3 3	9 8	Kramer 2 18 Irvine 1	Richfield Orange County
	00				orango county
RIVERSIDE COUNTY: L. R. Clark	3	3	2	1	Riverside County
R. B. Jackson	15	3	2	1	Riverside County
L. E. Smith	18	3	1	1	Riverside County
SAN BENITO COUNTY: Henry Harper	Ranc	ho An	tonis	9	San Benito County
SAN BERNARDINO COUNTY: Colton Terrace Oil Co.	25	1	5	1	San Bernardino Co.
Colton Terrace Oil Co. Western Pacific Oil Co.	4	10	4	2	San Bernardino Co.
SAN DIEGO COUNTY:					
Todd & Clark	69	18	1	1	San Diego County
SAN LUIS OBISPO COUNTY:					
E. J. Miley	Lot 11	, Ranc iguelit 11	ho San	1	San Luis Obispo Co.
Belridge Oil Co.	6	11	24	Judge 1	San Luis Obisno Co
Carlisle Oil Co E. T. Edwards	19 22	11 31	$\frac{25}{21}$	$\frac{1}{4}$	San Luis Obispo Co. San Luis Obispo Co.
J. T. Holland	22	32	22	1	San Luis Obispo Co.
SAN MATEO COUNTY:					
La Honda Oil Fields Assn		7	4	2	San Mateo County
SANTA BARBARA COUNTY:					
Union Oil Co.		9	34	Escolle 15	Casmalia
Gilmore & Riverside Oil Co	30	9	32	Bradley 2 Henderson 4	Santa Maria Santa Maria
Rice Ranch Oil Co.	23	9	34	10	Santa Maria
SANTA BARBARA COUNTY: Union Oil Co General Petroleum Corp Gilmore & Riverside Oil Co. Rice Ranch Oil Co. Walter W. Gregg. S. W. Lea, et al	Lot 17 Mar	7, Cerc	vision	1	Santa Barbara Co.
		4		$\frac{1}{2}$	Santa Barbara Co.
Sims Oil Interest_Lot 1, Rancho La E	spada	6	35	1	Santa Barbara Co.
TULARE COUNTY:	-		0.00		TD 1 C
Hub Oil Co. Hub Oil Co.	27 13	22 24	27 27	1	Tulare County Tulare County
Hub Oil Co. J. Mills Boal Shannon Oil Co.	3	23	27	1	Tulare County Tulare County
Shannon Oil Co.	15	22	27	2	Tulare County

Company	Sec.	Twp.	Range	Well No.	Field
VENTURA COUNTY:					
Acme Petroleum Corp. and Cal-Mex.					
Oil & Rfg. Co.	2 4	3	19	Frey 1	Bardsdale
Montebello Oil Co	4	3	19	Shiells 116	Bardsdale
J. A. Hess	4	1	20	1	Conejo
Rio Virgin Oil Syn.	33	2	20	9	Conejo
Rio Virgin Oil Syn.	33	2 2 4	20	10	Conejo
Torrey Petroleum Co.	32	4	18	3	Piru
Henderson & Robinson et al	25	4	22	Henderson	
				Union 16	Santa Paula
R. F. Labonge	1	4	20	Kentuck 12	Sespe
Oak Ridge Oil Co.	13	3	21	Harvey 15	South Mountain
Associated Oil Co.	27	3	23	Lloyd 17	Ventura
Associated Oil Co	27	3 3 3 3 3	23	Lloyd 18	Ventura
C. E. Brain	9	3	23	1	Ventura
Shell Co.	28	3	23	Gosnell 9	Ventura
Mon Odinana and American	20		20	Gobileii	v ciroura
OLO COUNTY:					
San Martinez Oil Co.	36	11	1	E. H. Bem-	
Contraction of Contraction	00	11	1	merley 1	Yolo County

SPECIAL ARTICLES.

Detailed technical reports on special subjects, the result of research work or extended field investigations, will continue to be issued as separate bulletins by the Bureau, as has been the custom in the past.

Shorter and less elaborate technical papers and articles by members of the staff and others are published in each number of 'Mining in

California.

It is anticipated that these special articles will cover a wide range of subjects both of historical and current interest; descriptions of new processes, or metallurgical and industrial plants, new mineral occurrences, and interesting geological formations, as well as articles intended to supply practical and timely information on the problems of the prospector and miner, such as the text of new laws and official regulations and notices affecting the mineral industry.

MINING LAW.

By A. H. RICKETTS, of the bar of the Supreme Court of the United States, of California and of Nevada.

Copyright, 1925, by A. H. Ricketts

Adjudicated Mining Terms and Phrases.*

TABLE OF CONTENTS.

	TABLE OF	CONTENTS.	
I.	Abandonment.	XXXV.	Classification of Land.
II.	Absence of Discovery.	XXXVI.	Computing Time.
III.	Abstract of Title.	XXXVII.	Concentrate.
IV.	Accident.	XXXVIII,	Constructive Possession.
V.	Act of God.	XXXIX.	Contiguous.
VI.	Adjacent.	XL.	Contributory Negligence.
VII.	Adoption of Boundary	XLI.	Copper Matte.
	Marks.	XLII.	Copper Ore and Copper
VIII.	Adverse Claim.		Concentrate.
	Adverse Intent.	XLIII.	Corporation.
X.	Adit.	XLIV.	Course of Employment.
XI.	Affidavit of Labor.	XLV.	Crevice.
XII.	Alien.	XLVI.	Cut.
XIII.	Annual Assessment Work.	XLVII.	Declaratory Statement.
XIV.	Annual and Patent Expen-	XLVIII.	Deposits.
	diture.	XLIX.	Description Required in
	Anticline and Syncline.		Other Cases.
XVI.	Anticlinal and Fissure	L.	Desert Lands.
	Veins.	LI.	Dewater.
	Appropriation.	LII.	Diatomaceous Earth.
XVIII.			Dip and Downward Course
	Assay Value.		Dump.
	Assessment Labor.		Election.
	Association.		Electro-Metallurgy.
	Association Location.		Entry.
	Barren Mine.		Escape Way.
	Battery.		Exception or Reservation.
	Bell Holes.		Exemptions.
XXVI.			Experts.
XXVII.			Extralateral Rights.
	Carnotite.	LXIII.	
	Character of Land.		Foreman.
	Citizens.		Forfeiture.
XXXI.			Fully Developed Mine.
	Claim Jumping.		General Manager.
	Claims Held in Common.	LXVIII.	G Acces of
XXXIV.	Claimant.	LXIX.	Going Concern.

^{*}For additional "Terms and Phrases" see Report XX of the State Mineralogist, April, 1924, "Oil and Gas Rights," Part 1, page 105, and appropriate titles in work on "Mining Law," in preparation.

TABLE OF CONTENTS—(Concluded).

	TABLE OF CON.	LEM IS- (COII	cruded).
LXX.	Government Ownership.	CXXXIX.	Placer Location.
LXXI.	Grizzlies.		Placer Mining.
	Headers.	CXLI.	Pop Shots.
	Held in Common.		Preference.
	High Grading.		Proceedings.
	Hydraulie Mining.		Process of Mining. Prospect Hole.
	Improvement. Independent Contractor.		Prospecting and Mining.
	Indian Title.		Protestant.
	Instrumentalities of Mining.		Provisional Locations.
	Lands Valuable for		Public Domain.
	Minerals.	CL.	Public Land.
LXXXI.	Lapsed.	CLI.	Public Mineral Land.
LXXXII.			Public Land and Public Use.
LXXXIII.	Lease by Federal Govern-		Pusher-Jigger Boss.
	ment.		Quarry.
LXXXIV.			Real Property.
	Location.		Relinquishment. Rule of Approximation.
	Location and Patent.	CLVIII.	
	Location and Record. Lode Location.		Salines.
LXXXIX.			Salting.
	Markings.		Salt Lick.
XCI.	Master and Servant.	CLXII.	Safe Appliances.
	Meander Line.	CLXIII.	Safe Place.
	Metallic.	CLXIV.	Scrip.
	Metallic Ore.	CLXV.	Seam.
	Metalliferous.	CLXVI.	
XCVI.			Shift Boss.
XCVII.			Shoestring Location.
	Mineral.	CLXIX.	
	Mineral Interests.	CLXX.	
	Mineral Lands.	CLXXI.	Smelter Returns.
CII	Mineral Right. Minerals Crude.		Smelting.
	Mineral Surveyor.	CLXXIV.	
CIV.	Miners' Devices.	CLXXV.	
	Miners' Inch.	CLXXVI.	
	Miner's Lien.	CLXXVII.	
	Miner's Weight.	CLXXVIII.	
	Mining. Mining and Milling.		Superintendent.
	Mining Claim.	CLXXX.	
	Mining District.	CLXXXI.	Taking Timber Necessary to Support Their Im-
	Mining Ground and Mining		provements.
	Land.	CLXXXII	This Vein.
CXIII.	Mining Purposes.		Timbering.
	Mining Right.		Tool Nipper.
CXV.	Mining Title.	CLXXXV.	Top and Apex.
	Models.	CLXXXVI.	To the Same Extent.
	Monuments. Mucker.	CLXXXVII.	
	Name of Lode.	CLXXXVIII.	Trespass.
	Negligence.	CLXXXIX	
	Not Previously Known to		Tunnel Claim.
	Exist.		Tunnel Right.
CXXII.	Obliterated Corner.		Tunnel Sites. Unavoidable Casualties.
CXXIII.	Occupant.		Unoccupied and Unappro-
CXXIV.	Occupation.	(1101).	priated Land.
	Official Plat of Survey.	CXCV.	Usual Mining Privileges.
	Oil Flotation.		Vacant Land.
	Oral Agreement to Locate.	CXCVII.	Veins and Lodes.
CXXVIII	Ore Dressing.	CXCVIII.	Wash.
	Ore in Sight.	CXCIX.	Water Rights.
CXXXI	Ore Personal Property.	CC.	Waste.
CXXXII	Other Valuable Deposits.	CCI.	Who Are and Who Are
CXXXIII	. Ouster.	~~	Not Co-owners.
	. Outstroke and Instroke.		Withdrawals.
	. Pedis Possessio.		Working a Claim. Workmen's Compensation
	. Photographs.	CCIV.	Acts.
	. Pillars or Stumps.	COV	Zone.
CXXXVIII	. Flacers.	CCV.	Zione.

Introductory.

Throughout the reports of decisions of the various federal and state courts and of the Land Department, occasionally are found definitions of terms or phrases made by them and peculiar to the mining or mineral industries. Those of particular interest to mineral operators in the West are here collated.

I. Abandonment.

"Abandonment" of a mining claim is a matter of intent 1 which is to be arrived at from consideration of the acts of the parties.2 Forfeiture results from failure to perform annual assessment work under the mining statutes, and the relocation of the land by another.3

II. Absence of Discovery.

It is a very common notion among prospectors in this country that if they sink a shaft, which they call a "discovery shaft" or run a cut or a tunnel for a few feet and put up their stakes, they acquire thereby some sort of an interest in the public domain, although within the limits of their shaft, cut or tunnel, there may be no indications whatsoever of a vein or mineral deposit and work has ceased. Whatever may be the comity in respect to this matter among miners and prospectors, as a matter of law such a location absolutely is worthless for any purpose.4

III. Abstract of Title.

An "abstract of title" is a paper prepared by a skilled searcher of records which should show an abstract of whatever appeared on the public records of the county affecting the title, but an abstract of title of an unpatented mining claim merely is of the nature of memoranda which never show the true or, at least, the complete title. Its examina-

which never show the true or, at least, the complete title. Its examina—

1 Black vs. Elkhorn Co., 163 U. S. 445. Peachy vs. Frisco Co., 204 Fed. 668.

2 Lakin vs. Sierra Buttes Co., 23 Fed. 337.

3 Goldberg vs. Bruschi, 146 Cal. 708, 81 Pac. 23.

Burden of proving abandonment is on party asserting it. Thornton vs. Phelan, —

Cal. A.—, 224 Pac. 259.

That the Supreme Court of the United States has not always recognized the distinction between abandonment and forfeiture: see Lavignino vs. Uhlig, 198 U. S. 443; Union Oil Co. vs. Smith, 249 U. S. 330, aff'g. 166 Cal. 217, 135 Pac. 966. In Farrell vs. Lockhart, 210 U. S. 142, the distinction is pointed out. Ground embraced within a mining location may become a part of the public domain so as to be subject to another location before the expiration of the period for performing the assessment work, where there is an abandonment of the claim by the first locator. Farrell vs. Lockhart, supra; Street vs. Delta Co., 42 Mont. 384, 112 Pac. 701; see Brown vs. Gurney, 201 U. S. 184; and see Nash vs. McNamara, 30 Nev. 114, 93 Pac. 405, criticising Lavagnino vs. Uhlig, supra.

4 McLaughlin vs. Thompson, 2 Colo. A. 135, 29 Pac. 817. See Enhardt vs. Boars, 113 U. S. 527; Bulette vs. Dodge, 2 Alaska 427.

If such a location is followed by possession with a view of making discovery and work to that end diligently is prosecuted such possession cannot be disturbed by strangers. Hullinger vs. Big Sespe Oil Co., 28 Cal. A. 69, 151 Pac. 369, but see Hanson vs. Craig, 170 Fed. 62. The diligence in such a case has been defined as "that constancy or steadiness of purpose or labor which is usual with men engaged in like enterprises, and who desire a speedy accomplishment of their designs; such assiduity in the prosecution of the enterprise as will manifest to the world a bona fide intention to complete it within a reasonable time. It is the doing of an act, or series of acts, with all practical expedition with no delay except such as may be instant to the work itself." U. S. vs. Midway Oil

See note 317, infra.

5 Smith vs. Taylor, 82 Cal. 533, 23 Pac. 219; Taylor vs. Williams, 2 Colo. A. 559, 31 Pac. 505.

Patterson vs. Hitchcock, 3 Colo. 533.

⁶ Patterson vs. Hitchcock, 3 Colo. 533.

"An abstract of title merely is a memorandum or a concise statement of the conveyances and incumbrances appearing of record and affecting the title to real property, and its object is to enable the purchaser or his counsel to readily pass upon the validity of the title in question as shown by the records, but, regardless of what is shown by an abstract or the public records a purchaser of real estate is charged with notice of the rights of persons in actual possession thereof." Foley vs. Brown, 85 Okla. 1, 204 Pac. 267; Duncan vs. Kelly,—Okla.

229 Pac. 425.

tion, therefore, should, properly be coupled with personal inspection of the ground and its vicinity in order to ascertain, (1) that the mineral deposit (if any), warrants the character of the location made 7; (2) that there is a valid "discovery" within the limits of the claim 8; (3) that the notice of location has been posted upon the claim as and where required by local statute 9; (4) that the location is so marked that its boundaries can be readily traced 10; (5) that the end lines are parallel 11; (6) that the location has not been laid across the vein or lode 12; (7) or upon its "dip" 13; (8) that there is no "known vein or lode" within a placer claim not separately located 14; (9) that the required annual expenditure has been made 15; that there is no conflicting surface claim. 16 The abstract of title is incomplete unless due note is made therein of the records of the local land office.¹⁷

2. Abstract of Title of Patented Claim. An abstract of title of a patented mining claim should include all data of record in the local recorder's office and in the local land office. 18 It may thus be made to appear that the patentee holds in trust for pretermitted coowners, or other owners 19; that dual patents have been issued 20; that the property is not free from subsisting lien.²¹ It is the date of the location notice and not the date of entry in the land office that determines pri-

ority of discovery and location of a patented lode claim.²²

The patent may have issued after title had already passed out of the United States, in which case it is void.²³

⁷ Cole vs. Ralph, 252 U. S. 295; Harry Lode, 41 L. D. 403. ⁸ Cole vs. Ralph, supra⁽ⁿ⁾; see Fox vs. Myers, 29 Nev. 169, 86 Pac. 793. ⁹ Butte Co. vs. Radmilovich, 39 Mont. 157, 101 Pac. 1078. As to state regulations see Butte City Co. vs. Baker, 196 U. S. 119; McCleary vs. Broaddus, 14 Cal. A. 60;

see Butte City Co. vs. Baker, 196 U. S. 119; McCleary vs. Broaddus, 14 Cal. A. 60; 111 Pac. 125.

10 Harper vs. Hill, 159 Cal. 253, 113 Pac. 162.

11 Elgin Co. vs. Iron Co., 14 Fed. 377, aff'd in 118 U. S. 196.

12 Flagstaff Co. vs. Tarbet, 98 U. S. 467.

13 Larkin vs. Upton, 144 U. S. 21; but see Van Zandt vs. Argentine Co., 8 Fed. 75; Bunker Hill Co. vs. Shoshone Co., 33 L. D. 142.

14 See McKay vs. Mesch, 274 Fed. 867; see, also, Reynolds vs. Iron Co., 116 U. S. 698; South Star Lode, 20 L. D. 204; but see South Butte Co. vs. Thomas, 260 Fed. 814, certiorari denied, 253 U. S. 486.

15 See Last Chance Co. vs. Tyler Co., 61 Fed. 557. The statutory affidavit of expenditure presents prima facie evidence of the fact, Book vs. Justice Co., 58 Fed. 106. and forms a link in the chain of title. Thompson vs. Pack, 219 Fed. 624.

16 Brannagan vs. Dulaney, 2 L. D. 744; Holt vs. Hazard, 10 Cal. A. 444, 102 Pac. 540, see Cook vs. Klonos, 164 Fed. 529.

The record of the certificate of location of a mining claim required by law does not necessarily disclose the title. The law prescribes what the certificate shall contain. This, however, gives the purchaser no information respecting conflicting claims. For this he is dependent on examination and inquiry. If a conflicting claim be ascertained the record still does not necessarily disclose the better title. Location and record may both be prior to those of a cross lode, and still the latter be the older title, by reason of an earlier discovery, perfected within the statutory time, of which the record gives no information. Patterson vs. Hitchcock, supra. (6)

15 See U. S. vs. Wesely, 189 Fed. 276; Adams vs. Smith, 273 Fed. 652.

15 Id. The register's final certificate of mineral entry (formerly receiver's final receipt) is not conclusive because it is subject to cancellation. Deffebach vs. Hawke. 115 U. S. 392: U. S. vs. Record oli Co., 242 Fed. 746, but see El Paso Co. vs. McKnight, 20 Turner vs. Sawyer, 150 U. S. 578; Suessenbach vs. Bank, 5 Dak. 477; 41 N. W. 662: Thomas vs.

²⁶ See supra, note 17; see, also, Round Mt. Co. vs. Round Mt. Co., 18, 180 Pac. 71.

²⁷ Forbes vs. Gracey, 9 Fed. Cas. 404; Butte Co. vs. Frank, 65 Pac. 1, 25 Mont. 344.

²⁸ Butte Co. vs. Frank, supra (²¹⁾; When a patent issues it becomes operative as of date of the final receipt. U. S. vs. Detroit Co., 200 U. S. 335; Cassidy vs. Silver King Co., 199 Fed. 102.

²⁸ Davis vs. Weibbold, 139 U. S. 525; Francoeur vs. Newhouse, 40 Fed. 618; N. P. R. Co. vs. Barden, 46 Fed. 606. In Gleason vs. White, 199 U. S. 54, the court said: "By mistake of the Land Department, two patents have been issued. * * * It is one of those unfortunate mistakes which sometimes occur, and which necessarily throw confusion and doubt upon titles." In Adams vs. Smith, supra (¹⁷⁾ both a mineral and an agricultural patent were issued partly embracing the same ground.

Placer patents always are doubtful, in theory at least.²⁴

Personal examination of the ground covered by a patent is proper as, in the event of misdescription therein, the monuments fixed by the official survey govern.25

IV. Accident.

An "accident" as used in its popular sense is any unlooked for mishap or untoward event not expected nor designed.26

V. Act of God.

An "act of God" as known in the law is an irresistible superhuman cause, such as no reasonable human foresight, prudence, diligence, and care can anticipate.27

VI. Adjacent.

The word "adjacent," as generally defined and understood, means by, or near, and close, but not actually touching; and nonadjacent, representing the opposite situation, means not near, and not close.28

VII. Adoption of Boundary Marks.

In Campbell vs. McIntyre, 29 it is said: "We see no reason why the corner posts of an adjoining well-known placer claim, may not with the consent of the owner of such adjoining claim, be adopted as corner posts by the locator. Such adoption does not in any way tend to confusion as to the boundaries of the claim so located. It is not unlike the case of the adoption of the stakes of a prior location which has been abandoned as in Conway vs. Hart, 129 Cal. 480, 62 Pac. 44, and in Brockbank vs. Albion Co., 29 Utah 367, 81 Pac. 863. In Eaton vs. Norris, 131 Cal. 561, 63 Pac. 856, the court sustained claims where two adjoining locations were each marked by stakes set at the four corners, two thereof being stakes upon the dividing line and common to both claims."

VIII. Adverse Claim.

The signification of the words "adverse claim" as used in the mining law, is a claim filed in the United States Land Office opposing an application for patent for mining premises made by another person.30

²⁴ McKay vs. Mesch, supra (14); see Thomas vs. South Butte Co., 211 Fed. 107; Barnard Co. vs. Nolan, 215 Fed. 996; see Dahl vs. Raunheim, 132 U. S. 261.
25 32 Stats. 545; Coffee vs. Emigh, 15 Colo. 184, 25 Pac. 83. See Silver King Co. vs. Conkling Co., supra (18) As to parties in possible adverse possession of the patented property see Reedy vs. Wesson, 1 Alaska 570; Wetzstein vs. Largey, 27 Mont. 212, 70 Pac. 717.
26 Indian Creek Coal Co. vs. Calvert, 68 Ind. A. 474, 110 N. E. 522. It is a general rule that the happening of an accident carries with it no presumption of negligence on the part of the employer. Johnson vs. Silver King Co., 54 Utah 34, 179 Pac. 64. But it is the duty of a mine operator or other employer where an employee is injured to exercise ordinary care to secure and provide first aid for the injured employee and in the exercise of such care to secure for the injured employee surgical and medical treatment at the hands of competent physicians and surgeons. Hunicke vs. Meramic Co., 262 Mo., 560, 172 S. W. 43; see Cushman vs. Cloverland, 170 Ind. 402, 84 N.E. 759.
27 Garrett vs. Beers, 97 Kan. 255, 155 Pac. 2; see Georgia Co. vs. Hall, 124 Ga. 324, 25 S. E. 679, 683, 684; Rosenwald vs. Oregon City Co., 84 Or. 15, 163 Pac. 831, Id. 164 Pac. 189; see, also, Lysaght vs. Lehigh Co., 254 Fed. 353.
28 Brick Pomercy Mill Site, 34 L. D. 324.
29 295 Fed. 47.
20 McCovara vs. McClay, 16 Mont. 234, 40 Pac. 602; see Uniton vs. Santa Bita Co.

Blick Folheldy Mill Site, 34 D. B. 327.
 29 295 Fed. 47.
 McCowan vs. McClay, 16 Mont. 234, 40 Pac. 602; see Upton vs. Santa Rita Co., 14 N. M. 120, 89 Pac. 275.

IX. Adverse Intent.

The terms "claim of right," "claim of title" and "claim of ownership," when used in the books to express "adverse intent," mean nothing more than the intention of the dissessor to appropriate and use the land as his own to the exclusion of all others, irrespective of any semblance or shadow of actual title.31

X. Adit.

"Adit" is a term in mining used to denote the opening by which a mine is entered, or by which the water or ores are carried away; called also a drift.32

XI. Affidavit of Labor.

The object of the acts providing for the recording of "affidavits of labor' evidently is to fix some definite way in which the proof as to the performance of the work or expenses incurred in the making of improvements might be, in many cases, more accessible. Such acts simply provide the method of preserving prima facie evidence of the fact that such requirement has been fulfilled. The failure to comply with the terms of such an act will not work a forfeiture.33

XII. Alien.

The location by an alien and all the rights following from such location, are voidable, not void, and are free from attack by any one except the government.34

XIII. Annual Assessment Work.

The terms "assessment" and "annual assessment labor," refer to the annual labor required by § 2324 Rev. St., (5 U. S. Comp. St. p. 5525. § 4620), that being commonly called by miners the "annual assessment" 'assessment work' and so described in many judicial opinions 35 and in at least two acts of Congress.³⁶ As applied to a mining claim, assessment work has nothing to do with locating or holding a claim before discovery. It is a condition subsequent to discovery and location to be performed in order to preserve the exclusive right of possession of a valid mining location upon which discovery has been made.37

XIV. Annual and Patent Expenditure.

Annual expenditure solely concerns adverse claimants of the same mineral land; goes to the right of possession and is determined by the

³¹ Crowder vs. Doe, 162 Ala. 151, 50 So. 430; Bessler vs. Power River Co., 95 Or. 271, 185 Pac. 573.

32 Gray vs. Truby, 6 Colo. 260; Electro Magnetic Co. vs. Auken, 9 Colo. 204, 11 Pac. 80. "In the United States, the word tunnel is used instead of adit in most cases, although properly a tunnel means a nearly horizontal excavation through the mountain, open at both ends, as a railroad tunnel." Schamel on Mining Law, page 19.

33 Book vs. Justice, supra. (19) See Musser vs. Fitting, 25 Cal A. 746, 148 Pac. 536. It has been held that the claim is not open to relocation until after the expiration of the time allowed by law for the recordation of the affidavit. Jones vs. Peck, 63 Cal. A. 397, 218 Pac. 1030.

34 Manuel vs. Wulff, 152 U. S. 505. See Ginaca vs. Peterson, 262 Fed. 904. The question of citizenship is immaterial and cannot be raised nor determined in suits between individuals except in "adverse suits." Holdt vs. Hazard, supra. (16)

36 See El Paso Co. vs. McKnight, supra (18); Union Oil Co. vs. Smith, supra. (19)

36 See Stats. 6; 30 Stats. 651.

37 Union Oil Co. vs. Smith, supra (3); McLemore vs. Express Co., 158 Cal. 563, 112 Pac. 59; Borgwardt vs. McKiterick, 164 Cal. 650, 130 Pac. 417.

To "resume work" is to actually begin work in good faith and diligently prosecute the same to completion before an adverse relocation actually has been made. McCormick vs. Baldwin, 104 Cal. 229, 37 Pac. 903; Hirschler vs. McKendricks, 16 Mont. 211; 40 Pac. 290. There can be no resumption of work in Alaska. Ebner vs. Alaska Co., 210 Fed. 599.

courts, alone. The sufficiency of the expenditure of five hundred dollars as a condition precedent to the obtaining of patent is wholly within the jurisdiction of the Land Department.38

XV. Anticline and Syncline.

An "anticline" is the crest of a ridge and the "syncline" the lower portion.39

XVI. Anticline and Fissure Veins.

The only difference between a vein in the form of a single anticlinal fold and the ordinary fissure vein is that the former has a crest, the limbs of which dip in opposite directions, while the latter has a terminal edge and a dip in but one direction.40

XVII. Appropriation.

The term "appropriation" in mining law means the posting of notice at or near the point where the ledge is exposed; next the recording of the notice; next the marking of the boundaries. 41

XVIII. Assay.

An "assay" is a means of ascertaining the commercial value of a mineralized substance, as, for example, ore or black sand, or the product of a mill or smelter, either by a "fire" or a "wet" process, 42 and is termed "ordinary assays," "commercial assays," "specimen assays," "control assays" and "umpire assays."

XIX. Assay Value.

The term "assay value" means the standard value of gold everywhere. 43 An average "assay value" of several samples can not be taken as an absolute mathematical demonstration of the value of an orebody 44 nor is the assay return necessarily conclusive of the value of the thing assayed 45; it may, however, tend to prove discovery. 46

³⁸ Poore vs. Kaufman, 44 Mont. 248, 119 Pac. 785.

³⁹ Empire Co. vs. Tombstone Co., 131 Fed. 341. When strata dip like the roof of a house, the strata are spoken of as forming an anticline or saddleback. Page Advd. Textbook on Geology, IV, 83. Inclining in opposite directions from a central axis; applied to stratified rocks when they incline or dip from a central unstratified mass; or when in consequence of crust movements they have been folded or pressed together so that they dip each way from a central plane, which indicates the line parallel to which the folding has taken place; opposed to synclinal. Cent. Dict. There is nothing in the court definitions which militates against the crest of an anticlinal roll being the apex of a vein. Jim Butler Co. vs. West End Co., 35 Nev. 375, 158 Pac. 881, aff'd in 247 U. S. 450 the apex of a vein. Jim Butler Co. vs. West End Co., 35 Nev. 375, 158 Pac. 881, aff'd in 247 U. S. 450.

⁴⁰ Jim Butler Co. vs. West End Co., supra. (9)

⁴¹ McCleary vs. Broaddus, supra. (9) See, generally, Gould vs. Markopa Co., 8 Ariz. 429, 76 Pac. 598.

"Im Butter Co. vs. West Para Co., See, generally, Gould vs. Markopa Co., 8 Ariz.

429, 76 Pac. 598.

But no location is complete without discovery therein. Cole vs. Ralph, supra. (*)

429 Puget Co., 96 Fed. 90; Phipps vs. Hully, 18 Nev. 133, 1 Pac. 669. For difference in results of wet and fire assays see Puget Co., supra; Schamel on Mining Law, page 12. For a discussion, where assays were made from mine specimens, from car samples, and from mill or battery samples, see Fox vs. Hale & Norcross Co., 108 Cal. 369, 41 Pac. 308. For method of sampling and assay on ore sales see Chisholm vs. Eagle Co., 144 Fed. 670. For assay as evidence see Cole vs. Ralph, supra (*): Mudsill Co. vs. Watrous, 61 Fed. 163; People vs. Whalen, 154 Cal. 472, 98 Pac. 194; Healy vs. Rupp, 28 Colo. 102, 63 Pac. 319; Phipps vs. Hully, supra.

Assays do not have to be taken to establish the existence of a vein, nor warrant a location thereon. Iron Co. vs. Mike & Starr Co., 143 U. S. 404; Madison vs. Octave Oil Co., 154 Cal. 768, 99 Pac. 178; Muldrick vs. Brown, 37 Or. 185, 61 Pac. 429.

43 Vietti vs. Nesbitt, 22 Nev. 390, 41 Pac. 151.

44 Golden Reward Co. vs. Buxton, 97 Fed. 413; Pittsburg Co. vs. Glick, 7 Colo. A. 43, 42 Pac. 188. Mr. Costigan, in his work on Mining Law (page 108), says: "A 'mill run' is where a number of tons of supposedly representative ore are run through a mill to serve as an indication of the value of the ore in the mining claim. It is, of course, a far better test of the worth of the ore than an assay is, since an assay tests the value of only a very small piece of ore, and so is much less likely to be representative of the lode."

45 Phinps vs. Hully, supra (*2); see Mudsill Co. vs. Watrous, supra (*2); Ormund vs. Assays destant and suppared the fed. 787.

the value of only a very small piece of ore, and so is finder less fixely to be representative of the lode."

⁴⁵ Phipps vs. Hully, supra (⁴²); see Mudsill Co. vs. Watrous, supra (⁴⁹); Ormund vs. Granite Co., 11 Mont. 303, 28 Pac. 289; see, also, Cheesman vs. Shreve, 40 Fed. 787.

⁴⁶ Healy vs. Rupp, supra (⁴²); see Cole vs. Ralph, supra, ⁴⁷ The results of assays of rock taken from a mining claim long after the date of its location are competent evidence to show that the locators discovered a vein at the time of location. Southern Cross Co. vs. Europa Co., 15 Nev. 383,

XX. Assessment Labor.

The term "assessment labor" refers to the annual labor required of the locator of a mining claim after discovery and not to work before discovery.47

XXI. Association.

The term "association" usually means an unincorporated organization composed of a body of persons, banded together for some particular purpose, partaking in its general form and mode of procedure of the characteristics of a corporation.48

XXII. Association Location.

A location made by an association of persons in one location covering one hundred and sixty acres is not eight locations covering twentyacres each. It is in law a single location, and as such a single discovery is sufficient to support such a location; also the only assessment work required is for a single claim.49

XXIII. Barren Mine.

A mine may be fully developed and yet, owing to the barrenness of the ore, it would be impossible to work it with profit. 50

XXIV. Battery.

A "battery" is made of three stulls placed together and put in at the pitch of the vein, usually located a few feet apart, up and down, and crosswise of a stope.51

XXV. Bell Holes.

"Bell holes" are holes dug, or excavations made at the section joints of a pipeline for the purpose of repairs.⁵²

XXVI. Boss.

The term "boss" means a master workman or superintendent, a director or manager.53

XXVII. Cap.

A "cap" is a square piece of plank or block wedged between the top of posts and the roof of a mine the better to hold the roof.⁵⁴

XXVIII. Carnotite.

"Carnotite" essentially is a vanadate of uranium and potassium, but with other bases present also. It is found as a canary-yellow impregnation in sandstone in western Colorado and eastern Utah. By the reduction of carnotite ore radium, bromide or chloride, uranium oxide and vanadium oxide are obtained. The elemental substances radium, uranium and vanadium generally are classed as metals. they are not produced, marketed nor utilized in their elemental or metallic state but as the compounds above mentioned.

⁴⁷ Union Oil Co. vs. Smith, supra. (8)
48 Pratt vs. R. C. Orphan Asylum, 46 N. Y. Supp. 1035; Ruple vs. DeJournette,
50 L. D. 139. See, also, U. S. vs. Trinidad Co., 137 U. S. 160.
49 Con, Mutual Oil Co. vs. U. S., 245 Fed. 521. See U. S. vs. California Midway Oil
Co., 279 Fed. 521. Reeder vs. Mills, 41 Cal. A. 426, 217 Pac. 562.
50 People vs. Whalen, supra. (42) For a case involving an "exhausted mine" see Martin vs. Walsenburg Co., 200 Fed. 270. Lillibridge vs. Lackawanna Co., 264 Pa.
St. 235, 107 Atl. 688.
51 Lesh vs. Tamarack Co., 186 Mich. 399, 152 N. W. 1022.
52 Moore vs. Hope Co., 76 W. Va. 651, 86 S. E. 565.
53 Johnson vs. Butte & S. Co., 41 Mont. 158, 108 Pac. 1057; Applebee vs. Albany Co., 12 N. Y. S. 576.

Johnson vs. Butte & S. Co., 41 Mont. 158, 108 Pac. 1057;
 N. Y. S. 576.
 Big Branch Co. vs. Wrenchie, 160 Ky. 668, 170 S. W. 16.

salts are used for scientific and medicinal purposes. Uranium is a heavy metal found chiefly in uraninite, carnotite, samarskite, and a few other rare minerals. Vanadium is a rare element, but acid and base forming, found in vanadates and allied to phosphorus. Carnotite is an impure vanadate of potassium and uranium. The elements of radium, uranium and vanadium are not dealt with in the metal market or the trades in their elemental form as metals, are not so produced or recovered immediately in the reduction of carnotite ore. While the two substances last named appear in some forms of special steels, the percentage so used is very small.

The compounds or oxides of the two elements are the forms used in the production of such steels. It follows therefore that carnotite is not a metalliferous mineral and a mineral location thereof within a

petroleum withdrawal can not stand.55

XXIX. Character of Land.

The question of the "character of land" can be raised only by the United States or those claiming under them ⁵⁶ and conclusively is determined in and by the Land Department. ⁵⁷ The question usually arises at the instance of some party connected with the paramount title, who claims the land to be nonmineral.⁵⁸ The Land Department, however, is authorized at any time before patent to inquire whether the original entry was in conformity to law. 59 A patent duly issued by the Land Department sets at rest for all time the question of the mineral or nonmineral character of the land described therein. 60

XXX. Citizens.

Mining claims within the United States may be located by citizens of the United States and by those who have declared their intention to become such citizens.61

- 2. Corporations. A corporation existing by virtue of the laws of the United States or of a state or territory of the United States is a citizen of the United States.62
- 3. Alaska. Native born citizens of the Dominion of Canada are accorded certain reciprocal mining rights and privileges within Alaska.63
- 4. Philippine Islands. Citizens of the United States and citizens of the Philippine Islands may make mining locations therein. 64
- 5. Land Office Employees. Citizens of the United States who are employed in the General Land Office are prohibited by statute from in any manner acquiring public land.65

 ⁵⁵ Con. Ores Co., 46 L. D. 468.
 ⁵⁶ Ryan vs. Granite Hill Co., 29 L. D. 522; Lorenz vs. Waldron, 96 Cal. 243, 31

⁵⁶ Ryan vs. Granite Hill Co., 29 L. D. 522; Lorenz vs. Waldron, 96 Cal. 243, 31 Pac. 54.

57 Burfenning vs. Chicago Co., 163 U. S. 321; Standard Co. vs. Habishaw, 132 Cal. 115, 64 Pac. 113. See Kirk vs. Olsen, 245 U. S. 225; Day, 50 L. D. 24.

58 Chrisman vs. Miller, 197 U. S. 313; aff'g 140 Cal. 440, 73 Pac. 1083, 74 Pac. 444, Book vs. Justice Co., supra (15); Olive Land Co. vs. Olmstead, 103 Pac. 568; Mutchmor vs. McCarty, 149 Cal. 603, 87 Pac. 85.

59 Kirk vs. Olson, supra (57); Nichols & Smith, 46 L. D. 26. See Cowell vs. Lammers, 21 Fed. 200. See, also, Wyoming vs. U. S., 255 U. S. 489.

60 Thomas vs. Horst, supra. (15) (13) Nev. 442.

61 Gleeson vs. Martin White Co., 13 Nev. 442.

62 McKinley vs. Wheeler, 130 U. S. 630; Doe vs. Waterloo Co., 70 Fed. 455.

63 See Instructions, 32 L. D. 424.

64 32 Stats. 697; amended, 33 Stats. 692.

65 Rev. Stat. § 452, Baltzell, 29 L. D. 333; Contzen, 38 L. D. 346.

XXXI. Claim.

The word "claim" in mining parlance when used as a noun has a definite meaning, denoting when coupled with the name of a miner, a particular piece of ground to which he has a recognized, vested and exclusive right of possession for the purpose of extracting metals and minerals therefrom. 66 The term is applied indifferently to both lode and placer claims.67

XXXII. Claim Jumping.

The location of a mining claim on supposably excess ground within the staked boundaries of an existing location on the theory that the law governing the manner of making the original location has not been complied with is called "claim jumping." 68

XXXIII. Caims Held in Common.

The phrase "held in common" means a claim whereof there are more ewners of a claim than one, while the use of the words "claims held in common," on which work done on one of such claims shall be sufficient, means that there must be more than one claim so held, in order to make a case where work on one of them shall answer the statutory requirement as to all.69

XXXIV. Claimant.

The word "claimant" as used in the federal mining law, means "locator," 70

XXXV. Classification of Land.

There is no certain, well-defined obvious line of demarcation between mineral and nonmineral land.71 No land can be valuable mineral land unless it contains a deposit of mineral in some form, metalliferous or nonmetalliferous in quantity sufficient to justify expenditures in the effort to extract it.72

XXXVI. Computing Time.

In "computing time," when notice is given in land office proceedings, the first day is excluded and the last day included.73

XXXVII. Concentrate.

In mining the term "concentrate" means to separate ore or metal from its containing rock or earth. The concentration of ores always proceeds by steps or stages. Thus the ore must be crushed before the mineral can be separated, and certain preliminary steps, such as sizing and classifying, must precede the final operations, which produce the finished concentrates.74

⁶⁶ N. P. R. Co. vs. Sanders, 49 Fed. 129. The word "claim" as used in the law affecting adversary patent proceedings refers to an unpatented claim. Iron Co. vs. Campbell, 135 U. S. 286; Wright vs. Town, 13 Wyo. 506, 81 Pac. 649.

⁶⁷ Sweet vs. Webber, 7 Colo. 443, 4 Pac. 752; see Bay State Co. vs. Brown, 21

⁶⁷ Sweet vs. Webber, 7 Colo. 443, 4 Pac. 752; see Bay State Co. vs. Fron., Fed. 167.

Fed. 167.

68 Nelson vs. Smith, 42 Nev. 302, 176 Pac. 265; see Stock vs. Plunkett, 181 Cal. 193, 183 Pac. 657; Murphy vs. Cobb, 5 Colo. 281; Arnold vs. Baker, 6 Neb. 134.

60 Chambers vs. Harrington, 111 U. S. 352; Union Oil Co. vs. Smith, supra. (9)

70 Garden Gulch Placer, 38 L. D. 31.

71 Ah Yew vs. Choate, 24 Cal. 562.

72 Deffeback vs. Hawke, supra (18); N. P. R. Co. vs. Soderberg, 188 U. S. 526; Brophy vs. O'Hare, 34 L. D. 596.

73 Bonesell vs. McNider, 13 L. D. 286; see Waterhouse vs. Scott, 13 L. D. 718; and see Rousseau, 47 L. D. 590. Where the relative priority of conflicting locations depends upon the exact hour of the day of filling for record, fractions of a day are taken into account. See Washington Co. vs. O'Laughlin, 46 Colo. 503, 105 Pac. 1092.

74 The Santa Clara, 181 Fed. 725.

XXXVIII. Constructive Possession.

"Constructive possession" is that possession which the law annexes to the legal title or ownership of property, when there is a right to the immediate actual possession of such property but no actual possession.75

XXXIX. Contiguous.

The term "contiguous" means touching sides, adjoning, adjacent. Two tracts of land touching only at a point, are not contiguous.76

XL. Contributory Negligence.

The term "contributory negligence" means that the law imposes upon every person the duty of using ordinary care for his own protection against injury. 77 It is not synonymous with assumption of risk. 78

XLI. Copper Matte.

"Copper matte" is a product obtained by smelting copper sulphide ores. It mainly is cuprous sulphide, with a varying quantity of ferrous sulphide.79

XLII. Copper Ore and Copper Concentrate.

"Copper ore" and "copper concentrates" are not interchangeable, but mean two distinct and different things. "Copper ore" is the raw material of nature; and "copper concentrate" is the product of any one of a number of forms of concentration processes. The concentrates invariably are more valuable than the ore, being the natural product after it has been mechanically treated. The mechanical operation involves important changes in the natural product. In the first place it is pulverized, and converted from a solid, rocky condition to a fine, powdered condition. Then water or oil is added, and a chemical change takes place, so that the chemical analysis of the concentrates is different from that of the crude ore from which the concentrate is made, and there is a sifting out from the metallic content of the ore of the mineral waste content of the ore. It converts a noncommercial ore into a commercial product.80

⁷⁵ Southern Ry. Co. vs. Hall, 145 Ala. 224, 41 So. 136. Where a mining claim lacks none of the essential elements of a location and the requisite expenditure is made thereon it can be held by constructive possession. Harris vs. Equator Co., 8 Fed. 863, Gowdy vs. Kismet Co., 22 L. D. 628. A miner is not expected to reside upon his claim nor to cultivate the ground nor to inclose it. Table Mt. Co. vs. Stranahan, 20 Cal. 210; see English vs. Johnson, 17 Cal. 107.

76 Hidden Treasure Mines, 35 L. D. 485, cited with approval in Anvil Co. vs. Code, 182 Fed. 205.

77 Beers, vs. Housatonic Co., 19 Conn. 466; Graham vs. Penn. Co., 139 Pa. St. 149, 21 Atl. 151; Gulf Co. vs. Shieder, 88 Tex. 152, 30 S. W. 902; see, also, De Honey vs. Harding, 300 Fed. 696. Neither the defense of contributory negligence nor the defense of assumption of risk can arise unless the defendant in the action—a mine operator—has been guilty of negligence which, but for want of both these defenses, would render the operator liable for damages to an injured miner, as in the absence of such negligence there is nothing against which to make such a defendant operator to defeat a recovery. Osage Co. vs. Sperra, 42 Okla. 726, 142 Pac. 1040. A miner whose duty it was to push loaded cars of ore from the mine to the dumping place and who instead of pushing or following the loaded car got upon the car to ride down a steep grade and who by reason of the velocity attained by the car was injured by reason of selecting the dangerous method of tramming the ore, was guilty of such contributory negligence as would prevent a recovery. Dilley vs. Primos Co., 64 Colo. 361, 171 Pac., 1147.

Pac. 1147.

**Bolese Bros. Co. vs. Kahl, 203 Fed. 627.

**Pierce Smith Co. vs. United Verde Co., 293 Fed. 109.

The Santa Clara, supra. ()

XLIII. Corporation.

A "corporation" is a legal entity and can have no greater rights than an individual in acquiring public lands. Hence a corporation, regardless of the number of its stockholders, may lawfully locate no greater area than is allowable in the case of an individual.82

2. Citizenship. A corporation is a citizen of the state within which it is incorporated 83 and it is conclusively presumed that all of its

stockholders are citizens.84

3. Ultra Vires Location. An "ultra vires location" is valid and until inquest of office found.85

XLIV. Course of Employment.

The term "course of employment" means where a miner is working within the period of the employment at a place he may reasonably be and while he is reasonably fulfilling the duties of his employment or is engaged in doing something incidental thereto.86

XLV. Crevice.

"Crevice" is a word sometimes applied to a mineral-bearing vein. 87

The word "cut" may have a meaning other than that employed in mining but when it is used in conjunction with "shaft" and "drift" it means a surface opening in the ground intersecting a vein and never is intended to apply to a ditch or trench temporarily open for the purpose of laying sewer pipe.88

XLVII. Declaratory Statement.

A "declaratory statement," in practical mining operations, is a term applied to the statutory certificate of location, and is a certificate or statement of the location, containing a description of the mining claim, verified by the oath of the locator, performing, when recorded, a permanent function. It is the beginning of the locator's paper title, is the first muniment of such title, and is constructive notice to all the world.89

81 McKinley vs. Wheeler, supra (62); Igo Placer, 38 L. D. 281; Bakersfield Co.,

The federal mining law does not use the term "declaratory statement," but by usage among miners the term has reference to the recorded certificate required by local statute or local rule. There is a clear distinction between a posted notice and the declaratory statement. Peters vs. Tonopah Co. 120 Fed. 589; Sanders vs. Noble, 22 Mont. 110, 55 Pac. 1037.

^{**} McKinley vs. Wheeler, *supra** (62)*; Igo Placer, 38 L. D. 281; Bakersfield Co., 39 L. D. 460.

** Gird vs. California Oil Co., 60 Fed. 531; Nome Co. vs. Snyder, 187 Fed. 385; Mitchell vs. Cline, 84 Cal. 409, 24 Pac. 164; Miller vs. Chrisman, *supra** (65)* Any device whereby one person is to acquire more than twenty acres or an association more than one hundred and sixty acres by one location is a violation of law, a fraud upon the government and without legal support. U. S. vs. Brookshire Co. 242 Fed. 718; U. S. vs. Midway Oil Co., 259 Fed. 343.

** North Noonday Co. vs. Orient Co., 1 Fed. 522; see Doe vs. Waterloo Co. *supra** (62)*; Jackson vs. White Cloud Co., 36 Colo. 122, 85 Pac. 639.

** Doe vs. Waterloo Co. *supra** (62)*

** Bose Claims, 22 L. D. 83; see Union Bank vs. Matthews, 98 U. S. 628.

** Granite Co. vs. Willoughby, 70 Ind. A. 77, 123 NE 195; see, also, Kish vs. California Ass'n. 190 Cal. 246, 212 Pac. 27.

** TSt. Anthony Co. vs. Shaffra, 138 Wis. 507, 120 N. W. 238; see Terrible Co. vs. Argentine Co., 89 Fed. 583; see, also, Barnard Co. vs. Nolan, *supra** (60)*; Beals vs. Cone, 27 Colo, 473, 62 Pac. 948; McShane vs. Kenkle, 18 Mont. 208, 44 Pac. 979; Muldrick vs. Brown, *supra** (60)*; Fox vs. Myers, *supra** (60)*

** McLaughlin vs. Bardsen, 50 Mont. 177, 145 Pac., 956.

** Gird vs. California Oil Co., *supra** (60)* Magruder vs. Oregon Co., 28 L. D. 177; Pollard vs. Shively, 5 Colo, 312; Metcalf vs. Prescott, 10 Mont. 283, 25 Pac. 1037; McCowan vs. McClay, *supra** (60)*; Hickey vs. Anaconda Co., 33 Mont. 62, 81 Pac. 806. See Cole vs. Ralph, *supra** (60)*; Hickey vs. Anaconda Co., 33 Mont. 62, 81 Pac. 806. See Cole vs. Ralph, *supra** (60)*; Hickey vs. Anaconda Co., 476, 421 Pac., 476.

XLVIII. Deposits.

The term "valuable mineral deposits" in section 2319 Revised Statutes, the expression "lands valuable for minerals" in section 2318 Revised Statutes, and the word "mines" in section 2323, Revised Statutes, the term "valuable deposits" in section 2325, Revised Statutes, as well as the expression "mines of gold" in section 2392, Revised Statutes, all refer to substantially the same thing and embrace both veins or lodes and placers.90

XLIX. Description Required in Other Cases.

In patent proceedings the words "and the description required in other cases" contemplate a plat and field notes of the survey properly made and approved by the surveyor-general as required in applications for lode claims.91

L. Desert Lands.

"Desert lands" are all lands exclusive of timber lands and mineral lands which will not, without irrigation, produce some agricultural crop.92

LI. Dewater.

"Dewater" is a term applied to pumping and removing water from a mine.93

LII. Diatomaceous Earth.

"Diatomaceous earth," also called infusional earth and kieselguhr, is a light earthy material which from some sources is loose and powdery and from others is more or less firmly coherent. It may resemble clay or chalk in physical properties, but can be distinguished at once from chalk by the fact that it does not effervesce when treated with acids. It generally is white or gray in color, but may be brown or even black when mixed with much organic matter. It is made up of remains of minute aquatic plants and is composed chemically of hydrous silica.

Owing to its porosity it has great absorptive powers and high insulating efficiency and is an effective filter. Its hardness, the minute size, and the shape of its grains make it an excellent metal polishing agent. Diatomaceous earth undoubtedly is a mineral substance and if found in such quantities and qualities as to render lands containing such deposits valuable, it constitutes a valuable deposit under the mining laws.94

LIII. Dip and Downward Course.

The words "dip" and "downward course" are synonymous. 55 The dip in different veins and in the same vein sometimes varies from a perpendicular to the earth's surface to an angle, perhaps, only a few

⁹⁰ Hawke vs. Deffebach, 4 Dak. 33, 22 N. W. 480; see, also, Pacific Coast Co. vs. N. P. R. Co., 25 L. D. 243; Forsythe vs. Weingart, 27 L. D. 680. The term "valuable mineral deposits" includes diamonds (14 Op. Atty. Gen. 115; see, also, Kentucky Co. vs. Kentucky Co., 141 Ky. 97, 132 S. W. 3997), and also guano, Richter vs. Utah, 27 L. D. 97.

⁹¹ Harsh, 2 L. D. 706; Donlan, 39 L. D. 354.

⁹² 19 Stats, 377, § 2; see, also, Peoples, 48 L. D. 554. Desert land claimants will rarely come in conflict with mining claimants. In such event contests are decided on the same principle as homestead entries. See 1 Lind. Mines (3 ed.), § 212; Costigan on Mining Law, page 88; Schamel on Mining Law, page 106. For validity of assignment by entryman see Eymann vs. Wright, 177 Cal. 144, 169 Pac. 1037. See, also, Ruple vs. De Journette, supra. (49)

⁹⁸ Mackie-Clemens Co. vs. Brady; 202 Mo. A. 551, 208 S. W. 152. See Evalina Co. vs. Yosemite Co., 15 Cal. A. 714, 115 Pac. 946; and see Miller vs. Chester Co., 129 Pac. 14 C. P. R. Co. 45 L. D. 223.

⁹⁵ Duggan vs. Davey, 4 Dak. 110, 26 N. W. 901.

degrees below the horizon. The dip is spoken of from three different points of view; (1) As to its inclination from a perpendicular to a horizontal, as so many degrees from the perpendicular or from the horizontal. A vein is thus described as having a dip of twenty degrees, thirty degrees, etc.; (2) As to the direction it takes from the strike or apex, by the points of the compass. If the strike were due east or west, and the vein in its course downward departed from the perpendicular at an angle so that a perpendicular shaft sunk at the apex would leave the vein to the north of such shaft, the dip in this point of view, would be said to be due north, or, the conditions reversed, due south. In this respect the dip—that is the direction of the dip—is said to be, and is, at right angles to the strike; (3) The dip is again spoken of as the portions of the vein successively encountered in getting down and away from the apex. The miner follows the dip when he works downward, leaving the apex further from and above him at each advance. He follows the strike when he works lengthways of the vein on a level; that is when he is advancing along the vein, rising neither toward the surface of the ground nor descending, but going on a level with the plane of the earth's surface. A failure to distinguish these three views of the dip in using the word sometimes leads to confusion. sake of definition let us call the dip from the first point of view the inclination dip, the second the compass dip, and the third the practical dip, for this is the practical idea of the miner when he speaks of following his dip.

Under this definition, a vein absolutely perpendicular to the plane of the earth's surface, an occurrence rarely if ever encountered, has no inclination dip nor compass dip. It has only the practical dip; but in actual mining, veins possess a dip from all three points of view. Keeping these definitions in mind, some expression of courts and argument of counsel become more clear. The word "dip" is not used in the mining act of congress. The expression there is "course downward". Dip is the miner's word which has attained the signification above

defined.96

LIV. Dump.

The intention with which the owner of the property extracts the ore from the ground, and the purpose and intention of the owner with which it is placed on the "dump," is controlling in arriving at a solution of the question whether the ore after having been extracted and placed in the "dump" is personalty or realty.97

LV. Election.

The offer contained in an option contract is called "election" and it gives rise to a subsequent contract between the parties to buy or sell, or perform whatever other acts have been specified in the option contract.98 The particular act or acts which constitute an "election" may be fixed by the terms of the option, as also the time when, the place where, and the person to whom it shall be made.99

⁹⁰ King vs. Amy Co., 9 Mont. 543, 24 Pac. 202.

⁹⁷ Steinfeld vs. Omega Co., 16 Ariz. 230, 141 Pac. 847. That a dump is considered a part of the mine, see Savage vs. Nixon, 209 Fed. 124. See, also, Nordstrom vs. Silverstein-Johnsen Co., 5 Alaska 208.

⁹⁸ Penn. Co. vs. Smith, 207 Pa. St. 210, 56 Atl. 426; see, also, Flickinger vs. Heck, 187 Cal. 114, 202 Pac. 1045. Cline vs. Hall,—Okla—, 232 Pac. 31.

⁹⁹ Flickinger vs. Heck, supra (**); see, generally, Craig vs. White, 187 Cal. 489, 202 Pac. 648.

Pac. 648.

LVI. Electro-Metallurgy.

"Electro-metallurgy" is a term characterizing all processes in which electricity is applied to the working of metals. 100

1. The term "entry" as applied in the appropriation of public land means that act by which an individual acquires an inceptive right to a portion of the unappropriated soil of the country. 101

2. Certificate of Entry. The "certificate of entry" now is issued by the Register of the proper land office, instead of by the Receiver as

formerly, to the party entitled by law thereto. 102

3. Certificate Equivalent to Patent. A certificate of entry is equivalent to a patent issued. 103 When in fact the patent does issue it relates back to the inception of the right of the patentee, and cuts off intervening claimants.¹⁰⁴ In the meantime the government holds the

naked legal title in trust for the entryman. 105

4. Effect of Patent. An entry sustained by a patent is conclusive evidence that there had been, at the time of the entry, a valid location 106; but the patent and entry do not conclusively evidence the length of time before the entry that such location existed. The time the location was made is an open question of fact, provable like any other fact.107 A failure to perform the annual assessment work after entry does not subject the claim to relocation, as a delay in issuing the

patent does not affect the rights of the applicant. 108

5. Cancellation of Entry. It is the province of the Land Department to investigate the legality of an entry prior to patent and cancel the certificate of entry, in whole or in part, so as to conform the entry to the law. 109 In other words, the Land Department, as a specially constituted tribunal, has jurisdiction over mining locations enabling it to declare them valid as well as invalid in accordance with the facts and the appropriate law as found and determined by it after due notice and hearing. 110 If the cancellation is based upon a misconstruction of the law, it can be corrected by the courts. 111

6. Repayment. An applicant whose application, entry, or proof has been rejected is entitled to repayment when neither such applicant nor his legal representatives shall have been guilty of any fraud or attempted fraud in connection with such application. 112 The demand must be verified and made through the local or general land office. 113

¹⁰⁰ Edison Co. vs. Westinghouse Co., 55 Fed. 508. See, also, Cowles Co. vs. Lowney,

To Edison Co. vs. Westinghouse Co., 55 Fed. 353. Sec., 42.5, 79 Fed. 331.

79 Fed. 331.

101 Sturr vs. Beck, 133 U. S. 541; Mason vs. U. S., 260 U. S. 545; see Witherspoon vs. Duncan, 71 U. S. 210; Wilson, 48 L. D. 380.

102 Witherspoon vs. Duncan, supra, (101)

103 Benson Co. vs. Alta Co., 145 U. S. 428; Cranes Co. vs. Scherrer, 134 Cal. 353, 66

Pac. 487; Davis vs. Fell, 59 Cal. A. 438, 211 Pac. 30.

104 Stark vs. Starrs, 73 U. S. 402; Amador Median Co. vs. South Spring Hill Co., 36 Fed. 668.

105 Witherspoon vs. Duncan, supra (101); see U. S. vs. Record Oil Co., supra, (181) 108 Creede Co. vs. Uinta Co., 196 U. S. 337; Last Chance Co. vs. Tyler Co., 61

Ped. 557

Fed. 557.

Fed. 557.

107 El Paso Co. vs. McKnight, supra (18); Lawson vs. U. S. Co., 207 U. S. 1; Creede Co. vs. Uinta Co., supra (160); Hickey vs. Anaconda Co., 33 Mont. 46; 81 Pac. 806; Washoe Co. vs. Junila, 43 Mont. 178; 115 Pac. 917; see, also, Butte & S. Co. vs. Clark-Montana Co. 249 U. S. 12.

108 Benson vs. Alta Co. supra (105); Neilson vs. Champagne Co., 111 Fed. 657, Marburg Lode, 30 L. D. 202; Batterton vs. Douglas Co., 20 Ida. 764; 120 Pac. 827; see South End Co. vs. Tinney, 22 Nev. 19, 35 Pac. 89.

109 Pfau, 39 L. D. 359; see, generally, Hamilton, 38 L. D. 597.

110 Clipper Co. vs. Eli Co., 194 U. S. 220; Cameron vs. U. S. 252, U. S. 450; Lane vs. Cameron, 45 App. D. C. 404; Yard, 38 L. D. 59; Nichols & Smith, supra (190); Pollock 48 L. D. 5.

111 Hawley vs. Diller, 178 U. S. 476.

⁴⁸ L. D. 5.

111 Hawley vs. Diller, 178 U. S. 476.

112 Kern Co., 48 L. D. 367; see Hawk, 41 L. D. 350.

113 Repayment, 39 L. D. 141.

⁷⁻³⁷⁰⁸³

7. Repayment of Excessive Deposits. It now is usual for the survever-general to make immediate repayment of any excess of an amount deposited for the platting of a mineral claim and other office work in his office.114

LVIII. Escape Way.

The term "escape way" as used in a mining statute means a passage way leading from the inside to the outside of the mine through which miners in the mine could escape. 115

LIX. Exception or Reservation.

A "reservation" or "exception" of the minerals in a tract of land conveyed is a separation of the estate in the minerals from the estate in the surface, and it makes no difference whether the word used is "excepted" or "reserved".116

LX. Exemptions.

Exemption laws are grants of personal privileges to debtors, which may be waived by contract or surrender or by neglect to claim before sale.117

LXI. Experts.

An "expert" is defined to be one who is skilled in any particular act, trade or profession, being possessed of peculiar knowledge concorning the same. Strictly speaking, an "expert" in any science, art or trade, is one who by practice or observation has become experienced therein.118

LXII. Extralateral Rights.

What in mining cases is termed the "extralateral right" is a creation of the mining laws of congress, and to learn what it is we must look to them rather than to some system of law to which it is a stranger. Besides, as congress has plenary power over the disposal of the mineral bearing public lands, it rests with it to say to what extent, if at all, the right to pursue veins on their downward course into the earth shall pass to and be reserved for those to whom it grants possessory or other titles in such lands.119

See Hanson, 38 L. D. 169, 469.
 Roberts vs. Tennersee Co., 255 Fed. 469.
 De Moss vs. Sample, 143 La. 243, 78 So. 486.
 Spitley vs. Frost, 15 Fed. Cas. 299; see Conde vs. Sweeney, 16 Cal. A. 160, 116

Pac. 319.

"Is Turner vs. Haar, 114 Mo. 325, 21 S. W. 737. The scope of "expert evidence" is not restricted to matters of science or skill, but to any subject in respect to which one may derive, by experience, special and peculiar knowledge. Zarnick vs. Reiss Co., 133 Wis. 290, 113 N. W. 752; Hamann vs. Milwaukee Co., 127 Wis. 550, 106 N. W. 1081. The positive testimony of miners who mined the ore and developed the mine and the engineers and others who made actual surveys of the mine involved in a controversy as to extralateral rights must be taken for more than the speculative theories of experts on the geology and formation of ore bodies and the mineralization of veins. Physical facts should be given greater weight than mere expert opinion and speculative theories. Alameda Co. vs. Success Co., 29 Ida. 618, 161 Pac. 868. See, also, Northern California Co. vs. Waller, 174 Cal. 277, 163 Pac. 214, Ward vs. Massachusetts Co., — Cal A. — 228 Pac. 363; People vs. Boggess, — Cal. —, 228 Pac.

setts Co...— (at A. —— 2.5 f at. 305, 1 replic vs. body cs. 1925 f at. 418.

119 Jim Butler Co. vs. West End Co., supra. (25)

Under the common law a mineral claimant would be entitled only to what might be over and under the surface of his mining claim, carved out by the extreme lines of location extended downward indefinitely; but the mining statute qualifies or enlarges this right in one respect only to the extent that the locator may follow the lode or vein from the apex found within the surface ground of his claim, on its dip, to and depth, although in its course downward it may depart from the perpendicular and enter the land adjoining. This right to follow the vein beyond the side line does not apply on the course or strike of the vein. Whilden vs. Maryland Co., 38 Cal. A. 270, 164 Pac. 908. See, also, Bourne vs. Federal Co., 243 Fed. 468.

LXIII. Float.

The term "float" or "float rock" means bunches, blotches, pieces, or boulders of quartz or rock lying detached from, or resting upon the earth's surface without any walls. 120

LXIV. Foreman.

A "foreman" is one who takes the lead in the work, and may or may not have authority over his fellow workmen, and because he takes the lead and points out the work to be done, it does not necessarily follow that he stands in the place of the master. 121

LXV. Forfeiture.

The term "forfeiture" does not appear in the federal mining law providing for the relocation of mining claims; but the courts employ the term as a comprehensive word indicating a legal result flowing from a breach of condition subsequent, subject to which the locator acquires his title. The term "forfeiture" as used in the mining customs and codes of California means the loss of a right previously acquired to mine a particular piece of ground, by neglect or failure to comply with the rules and regulations of the bar or diggings in which the ground is situated; as "abandonment" in its common-law sense, merely is a question of intention, and takes place when the ground is left by the locator, without any intention of returning or making any future use of it, independently of any mining rule or regulation. A right to hold and work a mining claim when acquired may be lost by a failure or neglect to comply with the rules or regulations of the miners, relative to acquisition and tenure of claims, in force in the bar or diggings where the claim is located; and if such rules and regulations are not complied with by those holding claims within the district, the ground becomes open to occupation of the next comer. 123

LXVI. Fully Developed Mine.

A mine composed of ore containing so little precious metal that it would not pay for the mere crushing of the rock after it was taken out might never be fully developed in the sense that the ore, such as it is, would be sufficiently exposed and ready for extraction to permit active operations in the regular course of mining to begin, and in such condition it might be said to be fully developed, and yet owing to the barrenness of the ore, it would be impossible to work it with profit. 124

¹²⁰ Book vs. Justice Co., supra ⁽¹⁵⁾; Meydenbauer vs. Stevens, 78 Fed. 787; see, generally, Waterloo Co. vs. Doe, 56 Fed. 685; Burns vs. Clark, 133 Cal. 634; 66 Pac. 12; Burns vs. Schoenfield, 1 Cal. A. 121, 81 Pac. 713; Robertson vs. Smith, 1 Mont. 410; Sullivan vs. Schultz, 22 Mont. 541, 57 Pac. 279.

¹²¹ Allen vs. Goodwin, 92 Tenn. 385, 21 S. W. 761. The word "foreman" is generally understood to mean a laborer, with power to superintend the labor of those working with him. Peterson vs. Whitebreast Co., 56 Iowa 673.

¹²² Goldberg vs. Bruschi, supra ⁽³⁾; Florence-Rae Co. vs. Kimbel, 85 Wash. 162, 147 Pac. 881.

Pac. 881.

Pac. 881.

Tag. St. John vs. Kidd, 26 Cal. 263. The state statutes are of no more force and effect than miner's rules and regulations. Stock vs. Plunkett, supra. The failure of a party to comply with a mining rule or regulation an not work a forfeiture, unless the rule so provides. Emerson vs. McWhirter, 133 Cal. 510, 65 Pac. 1036, aff'd in 208 U. S. 30; see Stock vs. Plunkett supra. For manner of proving forfeiture see Goldberg vs. Bruschi, supra (9); for manner of proving abandonment, see Trevaskis vs. Peard, 111 Cal. 599, 44 Pac. 246. The mere intention to abandon, if not coupled with yielding up possession or a cessation of user, is not sufficient; nor will the non-user alone without an intention to abandon be held to amount to an abandonment. Abandonment is a question of fact to be determined by a jury or the court sitting as such. Utt vs. Frey, 106 Cal. 397, 39 Pac. 807; Wood vs. Ettiwanda Co., 147 Cal. 233, 81 Pac. 512.

LXVII. General Manager.

The term "general manager" imports general authority to perform all reasonable things in conducting the usual and customary business of his principal.125

LXVIII. Giant.

A "giant" is the nozzle of a pipe used to convey water for hydraulic mining and is used for the purpose of distributing or properly applying and increasing the force of the water. 126

LXIX. Going Concern.

A "going concern" is one that continues to transact its ordinary business.127

LXX. Government Ownership.

The statutes asserting paramount title in the United States to mineral lands are in harmony with the laws of practice of other countries on the same subject.128

LXXI. Grizzlies.

"Grizzlies" are iron or steel bars used to sort or separate the rock or ore as it falls into the ore chutes. 129

LXXII. Headers.

"Headers" are pieces of plank—longer than a cap—extending over more of the roof and supported by two props, one at each end. 130

LXXIII. Held in Common.

The phrase "held in common" means a claim whereof there are more owners of a claim than one, while the use of the words "claims held in common" means that there must be more than one claim so held.131

LXXIV. High Grading.

The term "high grading" means the theft of ores. 132

LXXV. Hydraulic Mining.

"Hydraulic mining" is the process by which a bank of gold-bearing earth and rock is excavated by a jet of water, discharged through the converging nozzle of a pipe under a great pressure, the earth or debris being carried away by the same water, through sluices, and discharged on lower levels into the natural streams and water courses below; where the gravel or other material of the bank is cemented, or where the bank is composed of masses of pipe-clay, it is shattered by blasting with powder.133

Tex. C. A. —, 212 S. W. 518; Producers Co. vs. Mifflin Co., 82 W. Va. 311, 95 S. E. 950, see Carroll Cross Co. vs. Abrams Creek Co., 83 W. Va. 205, 98 S. E. 151. The president, secretary, or general manager of a mining corporation has no power, by reason of his office alone, to sell or lease the property of binding. Franklin vs. Havalena Co., 16 Ariz. 200, 141 Pac. 730; Simous vs. Inyo Co., 48 Cal. A. 524, 192 Pac. 144.

128 Roseburg Bank vs. Camp, 89 Or. 67, 173 Pac. 316.

129 White Co. vs. Pettes Co., 30 Fed. 865; Contra Costa Co. vs. Oakland, 159 Cal. 323, 113 Pac. 682.

128 U. S. vs. San Pedro Co., 4 N. M. 294 17 Pac. 337. Under the common law of England mines of gold and silver were the exclusive property of the crown and did

^{323, 113} Pac. 682.

128 U. S. vs. San Pedro Co., 4 N. M. 294 17 Pac. 337. Under the common law of England mines of gold and silver were the exclusive property of the crown and did not pass under a grant by the king under the general designation of lands or mines. Hicks vs. Bell, 3 Cal. 219; Queen vs. Earl of Northumberland, 1 Plow. 310.

129 Suborich vs. Alaska United Co., 251 Fed. 886.

139 Big Branch Co. vs. Wrenchie, supra. (30)

131 Chambers vs. Harrington, supra. (30)

132 Atolia Co. vs. Industrial Accident Comm., 175 Cal. 691, 167 Pac. 148. See Goldfield Co. vs. Richardson, 194 Fed. 198; Daniels vs. Portland Co., 202 Fed. 637.

123 Woodruff vs. North Bloomfield Co., 18 Fed. 753; see, also, U. S. vs. North Bloomfield Co., 53 Fed. 625; U. S. vs. Lawrence, 53 Fed. 633.

LXXVI. Improvement.

The word "improvement" means such an artificial change of the physical condition of the earth in, upon, or so reasonably near the mining claim as to evidence a desire to discover mineral therein or to facilitate its extraction, and in all cases the alteration must be permanent in character. 134

LXXVII. Independent Contractor.

An "independent contractor" as applied in mining operations is one who exercises independent control over the mode and method by which he produces the results demanded by the contract. 135

LXXVIII. Indian Title.

An Indian's right to occupancy of land, and that right recognized by the United States, constitutes "Indian title." 136

LXXIX, Instrumentalities of Mining.

The true meaning of such expressions as "shafts," "tunnels," "levels," "uprises," "cross cuts," "inclines," "sump," etc., when applied to mines signifies instrumentalities whereby and through which such mines are opened, developed, prospected and worked.¹³⁷

LXXX. Lands Valuable for Minerals.

The term "lands valuable for minerals" as used in the mining law applies to all lands chiefly valuable for nonmetalliferous deposits, such as alum, asphaltum, borax, guano, diamonds, gypsum, marble, mica, slate, amber, petroleum, limestone, and building stone, rather than for agricultural purposes. 138 Such lands are subject to disposition by the United States under the mining laws only. 139

¹⁸⁴ Fredericks vs. Klauser, 52 Or. 110, 96 Pac. 679. See Sheldon, 43 L. D. 156. The term "improvements" used in a contract of sale of a mine means such things as are placed thereon by way of betterment and which are of a permanent nature and which add to the value of the property as real property and aid in the extraction of mineral profitably and successfully. Seigloch vs. Bisbee, 106 Wash. 632, 181 Pac. 53. See Lewin vs. Telluride Co., 272 Fed. 597. There is a broad and distinctive difference as applied to the mining laws between the word "discovery" and the words "expenditures," "improvements" or "development," and the three latter are not synonymous with the first. Union Oil Co., 23 L. D. 223; see St. Louis Co. vs. Kemp, 104 U. S. 636; Jackson vs. Roby, 109 U. S. 440; Chambers vs. Harrington, supra (69); Good Return Co., 4 L. D. 221.

135 Wooton vs. Dragon Co., 54 Utah 459, 181 Pac. 597. See, generally, Alabama Co. vs. Smith, 203 Ala. 70, 82 So. 31; Coal Corp. vs. Davis, 17 Ala. 22, 81 So. 359.

136 Van Moore, 221 Fed. 9954. This right of occupancy has always been held sacred, something not to be taken from him, except by his consent, and then only upon such considerations as should be agreed upon. Minn. vs. Hitchcock, 185 U. S. 389; Hallowell vs. U. S., 262 U. S. 219; Sperry Oil Co. vs. Chisholm, 264 U. S. 488. See opinion, 50 L. D. 315.

185 Webb vs. American Co. 157 Fed. 205; see N. P. B. Co. vs. Soderberg, supra (72):

For "surface instrumentalities", see Cavanaugh vs Corbin Co., 55 Ment. 118, 117.

185.

185.

186.

187.

Pacific Coast Co, vs. N. P. R. Co., supra.

189.

Pacific Coast Co, vs. N. P. R. Co., supra.

189.

189.

Pacific Coast Co, vs. N. P. R. Co., supra.

189.

189.

189.

Pacific Coast Co, vs. N. P. R. Co., supra.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

189.

LXXXI. Lapsed.

The word "lapsed" is unknown to mining usage or laws and is not equivalent to the term "forfeited" nor does it mean a technical forfeiture.140

LXXXII. Lead.

The word "lead" applied to mines may have a more extensive meaning than the word "lode" or "ledge".141

LXXXIII. Lease by Federal Government.

In its control and disposition of its public mineral lands, the United States acts in its proprietary capacity, and not in virtue of any attribute of sovereignty. As paramount proprietor, it has the same right of control and disposition as is incident to absolute ownership in an individual.142

LXXXIV. Located.

The word "located" means delimited by having the boundaries ascertained and monumented on the ground, identified by having a notice of location posted upon the land, and further proclaimed to the public by having such notice of location recorded in the manner customary under the rules for recording mining claims. It has long been recognized, particularly in California, commencing with Miller vs. Chrisman, supra (58); see, also, Weed vs. Snook, 144 Cal. 439, 77 Pac. 1023; Merced Co. vs. Patterson, 153 ('al. 625, 96 Pac. 90, McLemore vs. Express Co., supra, (37) that a claim so located, whether discovery shall have been made or not, is property and the subject of conveyance and the passing of rights therein from one to another.143

LXXXV. Location.

A "location" is the act of taking or appropriating a parcel of mineral land. 144 It includes the posting of notices, the record thereof when required, and marking the boundaries 145 so that they can be readily The terms "location" and "mining claim" are synonymous, although a "mining claim" may consist of several "locations." 147

¹⁴⁹ Contreras vs. Merck, 131 Cal. 211, 63 Pac. 336, but see U. S. vs. California Midway oil Co., supra (40); Thornton vs. Phelan, supra. (51)
141 Inimitable Co. vs. Union Co., 1 Cal. Unrep. 599. The term "lode" is an alteration of the verb "lead." Eureka Co. vs. Richmond Co., 8 Fed. Cas. 819, whatever a miner would follow with the expectation of finding ore has been adopted and may be regarded as a practical test of what is considered a lode. Henderson vs. Fulton, 35 L. D. 661; King Solomon Co. vs. Mary Verner Co., 22 Colo. A. 528, 127 Pac. 129; Ambergris Co. vs. Day, 12 Ida, 115, 85 Pac. 109; see Eureka Co. vs. Richmond Co., 103 U. S. 839. Any body of mineralized rock is a lode. Book vs. Justice Co., supra (15); Shoshone Co. vs. Rutter, 87 Fed. 801.
142 Mid-Northern Oil Co. vs. Walker, 65 Mont. 414, 211 Pac. 353.
143 Union Oil Co. vs. Smith, supra. (5) Compare Cole vs Ralph, supra (7); U. S. vs. Sherman, 288 Fed. 498.
144 St. Louis Co. vs. Kemp, supra, (154) Cole vs. Ralph, supra (7); see, also Creede Co. vs. Unita Co., supra. (100)
A valid and subsisting location of mineral lands made and kept up in accordance with the provisions of the statutes of the United States, has the effect of a grant by the United States of the right of present and exclusive possession of the lands located. Gwillim vs. Donnellan, 115 U. S. 49; Manuel vs. Wulff, supra (10); compare White Star Co. vs. Hultberg, 220 Ill. 578, 77 N. E. 327. See Butte City S. H. L. Cases 6 Mont. 397, 12 Pac. 858.
145 Smith vs. Union Oil Co., 166 Cal. 217, 135 Pac. 966, aff'd in 249 U. S. 337; Sharkey vs. Candiani, 48 Or. 112, 85 Pac. 219.
146 Cole vs. Ralph, supra (7); Erwin vs. Perego, 93 Fed. 611; Walton vs. Wild Goose Co. 123 Fed. 209.
147 Del Monte Co. vs. East Chance Co., 171 U. S. 74.

LXXXVI. Location and Patent.

The "location" of a mining claim and a "patent" for a mining claim are not governed by the same rules. The mining statutes expressly provide for the location of surface ground that must include the lode or claim as discovered; and a patent can not grant any greater extent of surface ground than the location as made and marked by the surface houndaries.148

LXXXVII. Location and Record.

A "location and its record" are different things. The federal and state statutes distinguish between them, the former even in authorizing local rules "governing the location and manner of recording." The statutory object is to protect and reward discoverers of mines. Discovery with intent to claim is the principal thing and vest an estate—an immediate fixed right of present and exclusive enjoyment in the discoverer. The record is incidental machinery to secure to the discoverer his reward and to give notice to others. The spirit of all recordation acts is notice to protect others against secret equities. If the record is not necessary to create the estate (as it is in the matter of homestead exemptions and mechanic's liens), the statute providing for recording is but a direction to do certain acts and does not create conditions subsequent; and if the statute provides no forfeiture for failure to record, by failure the estate is not divested. 149

LXXXVIII. Lode Location.

Among practical miners the terms "lode," "lode location" and "mining claim" are used interchangeably. 150

LXXXIX. Maps.

A "map" is a drawing upon a plane surface representing a part of the earth's surface, and the relative position of objects thereon. It may also be so drawn as to show the geological structure and other physical facts necessary to a complete understanding of the matter at issue. 151

A map made by a surveyor showing a description and location of a mining claim in controversy is sufficiently supported where the surveyor testifies that he found fixed monuments on certain corners and on one side line of the claim and that in surveying he considered both the data on the ground as well as that given in the notice of location. Batt vs. Steadman, 36 Cal. A. 608, 173 Pac. 99.

In case of an unpatented mining claim, a map purporting to show the lines of the location is of no probative value unless supported by the evidence of some one who knows the position of the monuments which defined those lines; for it is by the location monuments alone that their beginning and direction can be determined. Miller vs. Grunsky, 141 Cal. 441, 66 Pac. 858; Daggett vs. Yreka Co., supra, see Blake vs. Doherty, 5 Wheat, 359; U. S. vs. Montana Co. 196 U. S. 573; Duncan vs. Eagle Rock Co., supra. But a map based upon a fabricated public survey may be referred to in and of the description of a mining claim. Girst vs. California Oil Co., supra. (2007)

When a witness refers to a map, he should be required to designate thereon, or by language to what reference is made, and in such manner that the whole testimony can be considered from the record. Oberstock vs. United Co., 68 Or. 197, 137 Pac. 195.

¹⁴⁸ Whilden vs. Maryland Co., supra, (110); see Silver King Co. vs. Conkling Co., supra, (100) The only distinction between a patentee of a mining claim and a mineral locator is in the ownership of the fee. Forbes vs. Gracey, supra (21); Duggan vs. Davey, supra, (90) The placer mining laws, which originally provided for the patenting of a fee estate in both the surface and the mineral deposits of public lands have been modified by various acts of congress to permit of the issuance of separate patents for the reserved mineral deposits under the mining laws. See Report XX of the State Mineralogist, July, 1924, "Oil and Gas Rights" Part IV, page 212.

10 Clark-Montana Co, vs. Butte & S. Co., 233 Fed. 547; see Stock vs. Plunkett, supra, (169)

Burra. Bu

XC. Markings.

Stakes, posts, piles of stone, boulders, blazing trees along the boundaries of the claim or at the corners thereof, cutting away undergrowth, making a trail through the timber along the sides or ends of the claim, putting up a stake at the point of discovery, blazing stumps, posting a notice at the point of discovery, posting a notice upon the ground, placing such notice in a tin can and attaching it to a stake, fastening such notice to a tree or placing it in a box, are all "markings.",152

XCI. Master and Servant.

One who represents and carries out the will of the master or of a mine operator in the prosecution of the work not only as to the result to be accomplished but also as to the means to be employed, is a servant and not an independent contractor. 153

XCII. Meander Line.

A "meander line" is a line run in a survey of a mining claim bordering upon a stream or other body of water, not as a boundary of the tract surveyed, but for the purpose of defining the sinuosities of the bank or shore of the water, and as a means of ascertaining the quantity of land within the surveyed area. 154

XCIII. Metallic.

The term "metallic" is used to indicate the condition of a metal in which it exists by itself, and is not mineralized nor combined with those substances which take away its metallic character and convert it into an ore.155

XCIV. Metallic Ore.

From a strictly scientific point of view, the terms "metallic ore" and "ore deposits" have no clear significance. They are purely conventional expressions, used to describe those metalliferous minerals or bodies of mineral having economic value, from which the useful metals can be advantageously extracted. In one sense rock salt is ore of sodium, and limestone an ore of calcium, but to term beds of those substances "ore deposits" would be quite outside of current usage. 156

XCV. Metalliferous.

The term "metalliferous" is not one admitting of precise definition. It means yielding or producing metals; as a metalliferous ore of deposit; a metalliferous district. But the metals and nonmetals are not subject, chemically or scientifically, to a conclusive definition or classification. 157

¹⁵² Meydenbauer vs. Stevens, supra (120); Ledoux vs. Forester, 94 Fed. 602; Walsh vs. Erwin, 115 Fed. 532; Oregon King Co. vs. Brown, 119 Fed. 51, 52; Holdt vs. Hazard, supra (15); Madeira vs. Sonoma Co., 20 Cal. A. 719, 130 Pac. 175; Allan vs. Dunlap, 24 Or. 236, 33 Pac. 675; see Book vs. Justice Co., supra (15); Tiggerman vs. Mrzlak, 40 Mont. 23, 105 Pac. 77. Posted notices may constitute a part of the marking and may aid in determining the situs of the monuments marking the claim, and they constitute a part of the marking, and while on account of the temporary nature may be of minor significance, yet this is not so where the location is followed by the actual and continued working of the claim. Eaton vs. Norris, 131 Cal. 565, 63 Pac. 826; see Jupiter Co. vs. Bodie Con. Co., 11 Fed. 666.

153 Clinton Co. vs. Bradford, 200 Ala. 308, 76 So. 79. The term "workman" or "workingman" means one whose time is at the disposal of his employer. Peo vs. Alvarez, 28 Porto Rico 890.

154 Alaska United Co. vs. Cincinnati Alaska Co., 45 L. D. 340. See Savard, 50 L. D. 381.

155 Hempstead & Son vs. Thomas, 122 Fed. 540.

156 Con. Ores Co., supra (55); see Montague vs. Dobbs, 9 C. L. O. 165; Overman Co. vs. Corcoran, 15 Nev. 152.

vs. Corcoran, 15 Nev. 152.

XCVI, Mine.

A "mine" is variously defined; an opening or excavation in the earth for the purpose of extracting minerals; a pit or excavation in the earth from which metallic ores or other mineral substances are taken by digging; an opening in the earth made for the purpose of taking out minerals, and in case of coal mines, commonly a worked vein; an excavation properly underground for digging out some usual product, as ore, metal, or coal, including any deposit of any material suitable for excavation and working as a placer mine; the underground passage and workings by which the minerals are gotten together with these minerals themselves. 158

A "mine" is a work for the excavation of minerals by means of pits, shafts, levels, tunnels, etc., as opposed to a "quarry," where the whole excavation is open. 159 In general the existence of a mine is determined by the mode in which the mineral is obtained, and not by its chemical or geological character. 160

The term "mine" also is defined as including only mines valuable

for their minerals or valuable mineral deposits. 161

The term "mine" as used in the Mining Act appears to be synonmous with the term "vein or lode." It also is used as synonymous with the term "mining claims." 163

There is a lack of unanimity in the decisions of the courts as to the status of an oil well. In some instances it is held to be a mine; and in other cases that it is not a mine. 164

XCVII, Miner.

A "miner" is one who mines, a digger for metals and other minerals. He is not necessarily a mechanic, handcraftsman or artisan, and the term imports neither learning nor skill.165

158 N. P. R. Co. vs. Mjelde, 48 Mont. 287; 137 Pac. 386.

159 Murray vs. Allred, 100 Tenn. 100, 43 S. W. 355, see People vs. Bell, 237 Ill. 332, 86 N. E. 593; Escott vs. Crescent Co., 56 Or. 192, 106 Pac. 452; see, also, Darvill vs. Roper, 3 Drewry 294; see Jacobs Law Dict.

160 Johnson vs. California Lustral Co., 127 Cal. 283, 59 Pac. 595; see, also, Rex vs. Dunsford, 2 Adol. & Ell., 568.

161 Davis vs. Weibbold, supra (199); Dower vs. Richards, 151 U. S. 658; Barden vs. N. P. R. Co., 154 U. S. 288; Callahan vs. James, 141 Cal. 291, 74 Pac. 853; Nephi Co. vs. Juab Co., 33 Utah 114, 93 Pac. 53. "Mines" as the term is known to the mineral laws of the United States, "embrace nothing but deposits of valuable mineral ores, and do not include mere masses of nonmineralized rock, whether rock in place or scattered through the soil." Wheeler vs. Smith. 5 Wash. 704.

162 Bullion-Beck Co. vs. Eureka Hill Co., 5 Utah 3, 103 Pac. 881. An unpatented location is a "mine" within the purview of the mining act. A mine upon a patented homestead is not less a mine because the title from the government was acquired under the laws providing for the disposition of agricultural lands only. An undeveloped body of ore is not a "mine" though the title to it was secured under the mineral laws, but it is merely a part of the real estate itself. NPR. Co. vs. Mjelde, supra. (188) Mjelde, supra. (158)

163 Idaho Co. vs. Davis, 123 Fed. 396; Hamilton vs. Delhi Co., 118 Cal. 148, 50 Pac. 378; Phillips vs. Salmon River Co., 9 Ida. 149, 72 Pac. 886.

The word "mine" as used in the mining law, may be used to designate "the whole claim or body of mining ground." Smith vs. Sherman Co., 12 Mont. 524, 31 Pac. 72; Tredinnick vs. Red Cloud Co., 72 Cal. 78, 12 Pac. 152, but see Shaw vs. Wallace, 25

Tredinflick vs. Red Cloud Co., 72 Cal. 78, 12 Pac. 152, but see Snaw vs. Wallace, 28 N. J. L. 461.

164 Berentz vs. Belmont Oil Co., 148 Cal. 577, 84 Pac. 47; Mid-Northern Co. vs. Walker, supra (142); see Burke vs. S. P. R. Co., 234 U. S. 967; compare Hollingsworth vs. Berry, 107 Kan. 544, 192 Pac. 763; Kreps vs. Brady, 37 Okla. 754, 133 Pac. 216; Carter vs. Phillips, 88 Okla. 202, 212 Pac. 747; J. M. Guffey Co. vs. Murrel, 127 La. 483, 53 So. 705.

165 Watson vs. Lederer, 11 Colo. 577, 19 Pac. 602. A laborer at an oil well is not a miner. J. M. Guffey Co. vs. Murrel, supra. (164)

XCVIII. Mineral.

In its broadest and scientific meaning, a "mineral" is any inorganic species having a definite chemical composition. 166 In its commercial sense the term "mineral" has been defined as any organic substance found in nature having sufficient value separate from its situs as part of the earth to be mined, quarried, or dug for its own sake or its own specific use. 167 When used in grants or in reservations or instruments of conveyance the term "mineral" is not limited to metals nor metalliferous deposits, whether contained in veins that have well-defined walls or in beds or deposits that are irregular and are found at or near the surface or otherwise. 168

XCIX. Mineral Interests.

"Mineral interests" in land means all the minerals beneath the surface. Such interests are a part of the realty and the estate in them is subject to the ordinary rules of law governing the title to real property.169

C. Mineral Lands.

The term "mineral lands" includes land which is worth more for mining than for agriculture. The fact that the land contains some gold or silver would not constitute it "mineral land" if the gold and silver did not exist in sufficient quantities to pay to work. 170 Land not mineral in character is subject to entry and patent as a homestead however limited its value for agricultural purposes. 171

Cl. Mineral Right.

A "mineral right" imports a title or right to all that is mineral in the land.172

CII. Minerals Crude.

"Minerals crude" is a term used in the classification of ores under the tariff act of 1897 and embraces "minerals, crude or not advanced in value or condition by refining or grinding, or by other processes not especially provided for in the act; or metallic mineral substances in a crude state and metals unwrought, not specifically provided for in this act.", 173

los See Glasgow vs. Farie, L. R. 13 A. C. 657. The term "mineral" should not be confined to metals or metallic ores. All metals are minerals, but all minerals are not metals. N. P. R. Co. vs. Soderberg, supra. (72)

107 Rock House Co. vs. Raleigh Co., 83 W. Va. 20, 97 S. E. 684.

108 It can not be said that the term "minerals" includes only such substances as are procured by tunnelling and shafting, as much gold is procured by placer mining, and rich deposits of manganese and other like ores are found upon the surface of the earth and sometimes are obtained without either quarrying or mining, Byron vs. Utah Co., 53 Utah 151, 178 Pac. 53; see Glasgow vs. Farie, supra. (166) The word "mineral" includes petroleum rights. Lovelace vs. Southwestern Co., 267 Fed. 504, 514. See Burke vs. S. P. R. Co., supra. (166) Mineralized matter is crushed and loose rock material containing minerals irregularly deposited, from solution. It may be in beds, or in fissures. Eureka Co. vs. Richmond Co., Fed. Cas. 4548; Doe vs. Waterloo Co., 54 Fed. 943.

⁵⁴ Fed. 943.

109 Hollman vs. Johnson, 164 N. Car. 268, 80 S. E. 249; see, also, Riggs vs. Board, 181 Ind. 172, 103 N. E. 1077. Mining rights and interests in minerals are the subject of horizontal severance from the surface and taxable as real estate. Riggs vs.

of horizontal severance from the surface and taxable as real estate. Riggs vs. Board, supra.

150 Deffeback vs. Hawke, supra. (120)
151 Davis vs. Wiebold, supra. (130)
152 Deffeback vs. Hawke, supra. (120)
153 Deffeback vs. Hawke, supra. (120)
154 Developes Dev. Co., 1 Fed. (2nd) 57.
155 See U. S. vs. Kostlak, 207 Fed. 450.
156 Peoples Dev. Co. vs. S. P. Co., 277 Fed.
157 He. See, also, U. S. vs. S. P. R. Co., 251 U. S. I, citing Benjamin vs. S. P. R. Co., 252 U. S. Vs. McGraw vs. Lakin, 67 W. Va. 385, 68 S. E. 27.
157 Hempstead & Son vs. Thomas, supra. (130)
158 Hempstead & Son vs. Thomas, supra. (130)
159 U. S. vs. Graser-Rothe Co., 164 Fed.
150 S. U. S. vs. Brewster, 167 Fed. 122; Myers vs. U. S., 178 Fed. 468; Con. Ores
150 Co., supra. (130)
150 See, also, Carothers vs. Mills, — Tex. — , 233 S.W. 155.

CIII. Mineral Surveyor.

A "mineral surveyor" is an officer or employee of the general land office within the scope of section 452 of the Revised Statutes of the United States. 174

CIV. Miners' Devices.

Miners use various devices to protect the posted notice from destruction by the elements, such as covering it with glass, or folding it in a box and placing the box in a conspicuous place, or putting the notice upon a mound of rocks, folding it and partially covering it with a rock 175 or putting the notice in a tin can. 176 A substantial compliance with the law is sufficient. 177

CV. Miners' Inch.

The term "miners' inch" is not definite without specification of the head or pressure. 177a It has no fixed meaning and in one locality sometimes is a very different quantity according to "miner's measurement" in another locality. 177b It has been defined as "the amount of water that will pass in twenty-four hours through an opening one inch square under a pressure of six inches." 178

In California "the standard miner's inch of water shall be equivalent or equal to one and one-half cubic feet of water per minute, measured through any aperture or orifice." Stats. 1901, p. 660.

CVI. Miner's Lien.

A "miner's lien" is a creature of statute to which the miner must look for the right and authority to file any such lien. 179

CVII. Miner's Weight.

The term "miner's weight" used in a coal mining lease as the basis for the price per ton to be paid for mining, is not a fixed, unvarying quantity of mine-run material, but is such a quantity of material as operators and miners may, from time to time, agree as being necessary or sufficient to produce a ton of prepared coal. 180

¹⁷⁴ U. S. vs. Havenor, 209 Fed. 989. The matter of employment and the manner and amount of payment of a mineral surveyor are left wholly to the option of the mineral claimant and such officer. Fish & Hunter Co. vs. New England Homestead Co.,

amount of payment of a mineral surveyor are left whonly to the option of the mineral claimant and such officer. Fish & Hunter Co. vs. New England Homestead Co., 28 S. Dak. 590.

175 Donahue vs. Meister, 88 Cal. 121, 25 Pac. 1096. It can not be said as a matter of law that a notice of location of a mining claim is insufficient where the notice was written on a piece of white paper and placed on a stick leaning up against a side cut upon the surface rock, and another rock being put on top of the paper so that it would not blow away, the paper being large enough to show under the rock, but the writing itself was not exposed. Emerson vs. Akin, 26 Colo. A. 40, 140 Pac. 482. In Hagan vs. Dutton, (20 Ariz. 476, 181 Pac. 581) the posting of the notice of location between the rocks of one of the location monuments of stone, although hidden from view by dirt and grave!, was held sufficient.

176 Gird vs. California Oil Co., supra. (62)

277 Donahue vs. Meister, supra. (75)

278 Dougherty vs. Haggin, 56 Cal. 522; see Gardner vs. Wright, 49 Or. 609, 91 Pac. 286. An "inch" is estimated on the basis of forty inches to one second foot. Hough vs. Porter, 51 Or. 318, 98 Pac. 1083. "Head of water" is the quantity entering the intake of any canal or ditch. Ulrich vs. Pateros Co., 67 Wash. 328, 121 Pac. 818.

278 27 Cyc. 515; see Longmire vs. Smith, supra. (177a) For an interesting case see Lillis vs. Clear Creek Co., 32 Cal. A. 668, 163 Pac. 1041. See, also, Morrison's Mining Rights, (15th ed.), 702.

Lillis vs. Clear Creek Co., 32 Cal. A. 668, 163 Pac. 1041. See, also, Morrison's Mining Rights, (15th ed.), 702.

In cases of ambiguity oral evidence may explain what is meant by the use of the term "miners' inch." Ulrich vs. Pateros, supra.(177a) See Logan vs. Guichard, 159 Cal. 592, 114 Pac. 989; Gardner vs. Wright, supra.(177b)

150 Bishop vs. Henry, 84 Or. 389, 165 Pac. 239.
180 Drake vs. Berry. 259 Pa. St. 8, 102 Atl. 320; see, also, Drake vs. Lacoc, 157 Pa. St. 17, 27 Atl. 538. For a case involving specific gravity and cubic feet requisite to make a ton of ore; see Silver.King Co. vs. Conkling Co., 255 Fed. 744.

CVIII. Mining.

The word "mining" includes placer mines in which the workings are open, and hence the question whether an enterprise is mining or not can not be determined by an inquiry as to whether the workings are open or underground.181

CIX. Mining and Milling.

"Mining and milling" would seem to be, taken together, one industry, having for its object "to obtain possession of material products in the state in which they were fashioned by nature." Mining the process of extracting from the earth the rough ore, would seem to be the first step in the process, milling or reducing the second step, to wit: the further separating of the materials found together, the one from the other, and extracting from the mass the particular product desired. 182

CX. Mining Claim.

As the term "mining claim" is used in the mining act, a "mining claim" is that portion of a vein or lode and of the adjoining surface, or of the surface and subjacent material to which a claimant has acquired the right of possession by virtue of a compliance with such statute and the local laws and rules of the district within which the location may be situated. 183 Independent of acts of Congress providing a mode for the acquisition of title to the mineral lands of the United States, the term "mining claim" has always been applied to a portion of such lands to which the right of exclusive possession and enjoyment by a private person or persons, has been asserted by actual occupation, or by a compliance with the local mining laws, or district rules.184

2. Distinction between Mining Claim and Location. The terms "mining claim" and "location" are not always synonymous and may often mean different things, as a mining claim may refer to a parcel of land containing precious metal in its soil or rock, while location is the act of appropriating such land according to certain established rules. 185 A "mining claim" may include as many adjoining locations as the locator may make or purchase, and the ground covered by all, though constituting what he claims for mining purposes will

constitute a "mining claim" and will be so designated. 186

CXI. Mining District.

supra,(49)

A "mining district" is a section of country usually designated by name, having described or understood boundaries within which mineral is found and which is worked under rules and regulations prescribed by

¹⁸¹ Burdick vs. Dillon, 144 Fed. 741. One engaged in the construction of shafts, tunnels, and the like, for prospecting and developing a mine, is engaged in mining as much as he who extracts ore or gravel from the mine. Johnson vs. California Lustral Co., supra. (100)

The process of mining is a "business." Stratton's Independence vs. Howbert, 231 U. S. 399; Sutter Co. vs. Nichols, 152 Cal. 688, 93 Pac. 872. But the business of mining is not a public utility in the absence of a local constitutional provision. See Con. Channel Co., 51 Cal. 269; Amador Queen Co. vs. DeWitt, 73 Cal. 482, 15 Pac. 74. See, generally, Clark vs. Nash, 198 U. S. 361; Strickley vs. Highland Boy Co., 200 U. S. 527; Goldfield Con. Co. vs. Old Sandstorm Co., 38 Nev. 426, 150 Pac. 313; Highland Boy Co. vs. Strickley, 28 Utah 215, 78 Pac. 296.

122 Rollins, 102 Fed. 985.

123 Trinity Co. vs. Beaudry, 223 Fed. 741; Morse vs. DeArdo, 107 Cal. 622, 40 Pac. 1018.

^{1018.}

Pac. 1018.

Pac. 1018.

184 Mt. Diablo Co. vs. Callison, 17 Fed. Cas. 9886; Argonaut Co. vs. Kennedy Co., 84 Fed. 2; Escott vs. Crescent Co., supra. (169)

185 St. Louis Co. vs. Kemp (134); Peabody Co. vs. Gold Hill Co., 97 Fed. (661; McFeters vs. Pierson, 15 Colo. 203, 24 Pac. 1076. The words "claim" and "location" are used interchangeably. Del Monte Co. vs. Last Chance Co., supra. (145)

186 St. Louis Co. vs. Kemp, supra (136); Carson City Co. vs. North Star Co., 83 Fed. (664; see U. S. vs. Brookshire Oil Co., supra (182); Con. Mutual Oil Co. vs. U. S., Supra (192)

the miners therein. 187 There is no limit to its territorial extent 188 and its boundaries may be changed if vested rights are not thereby interfered with. 189

2. Persons. No certain number of persons are necessary to effect its organization. 190

3. Corporations. A corporation may take part in the formation

of a mining district.191

- 4. Regularity of Proceedings. The regularity of the mode in which the district was organized will not be inquired into by the courts unless some fraud be shown. 192
- 5. Officers of District. The officers of a district are usually limited to a "Mining Recorder," who is elected by the miners thereof and therein, for a specified term.

6. Duties of Recorder. He should keep proper books for recording instruments therein. 193 Errors of recordation are not necessarily

fatal.194

7. Organization. The organization of mining districts is entirely optional with the miners, as there is no law requiring such organization.195

CXII. Mining Ground and Mining Land.

No land can be a "mining claim" unless based upon a location; otherwise it may be "mining ground" or a "mine." 196 For instance, the bed of a navigable river is not subject to mining location, but if mining is conducted thereon by dredging, it is mining ground; 197 or, where land is covered by an agricultural patent and worked for its mineral deposits, it is "mining ground" and not a "mining claim." 198 Hence, land from which a mineral substance is obtained from the earth by the process of mining may, with propriety, be called "mining ground" or "mining land" although the terms "valuable for minerals" and "valuable for mineral deposits" are not equivalent to the term "mining ground." 200

CXIII. Mining Purposes.

The phrase "mining purposes" as used in connection with mill-site locations, is very comprehensive, and may include any reasonable use for mining purposes which the quartz lode mining claim may require for its proper working and development. This may be very little, or it may be a great deal. The location of a quartz lode mining claim is required to do only one hundred dollars worth of work each year until he obtains a patent therefor. But if he does only this amount, and uses the mill-site in connection therewith, is not this the use of a mill-site for

U. S. vs. Smith, 11 Fed. 487; see Campbell vs. Rankin, 99 U. S. 261.
 King vs. Edwards, 1 Mont. 235.

¹⁸⁹ Id.

190 But see Fuller vs. Harris, 29 Fed. 814.

191 McKinley vs. Wheeler, supra. (62)

192 Gore vs. McBrayer, 18 Cal. 583.

193 Fuller vs. Harris, supra (6); McCann vs. McMillan, 129 Cal. 350, 62 Pac. 31.

194 Myers vs. Spooner, 55 Cal. 257; Weese vs. Barker, 7 Colo. 178, 2 Pac. 219.

195 Rose Claim, 22 L. D. 83.

196 Forbes vs. Gracey, supra (21); Williams vs. Santa Clara Ass'n., 66 Cal. 193, 5

Pac. 85; Bewick vs. Muir, 83 Cal. 368, 23 Pac. 389; Morse vs. De Ardo, supra (183);

198 Ball vs. Tolman, 119 Cal. 358, 51 Pac. 546.

197 Ball vs. Tolman, supra. (199)

198 Morse vs. De Ardo, supra (199)

199 People vs. Bell, supra. (199)

199 People vs. Bell, supra (199)

190 People vs. Bell, supra (199)

190 People vs. Bell, supra (199)

190 People ws. Bell, supra (199)

191 Paper (199)

192 Johnson vs. California Lustral Co., supra. (190)

mining purposes in connection with the mine? Who shall prescribe what shall be the kind and extent of the use under the statute so long as it is used in good faith in connection with the mining claim for a mining purpose.201

CXIV. Mining Right.

A "mining right" upon a specific piece of ground is a right to enter upon and occupy the ground for the purpose of working it, either by underground excavations or open workings, to obtain from it the mineral ores which may be deposited therein.

By implication the grant of such right carries with it whatever is

incident to it, and necessary to its beneficial enjoyment.²⁰²

2. Distinction between Conveyance of Mineral and Grant of Mining There is a clear distinction between an absolute conveyance of minerals in place and the grant of a "mining right" to another upon certain described land to convert the mineral into personalty and dispose of it. In the former case there is a severance of the title to the realty; in the latter, there is not, although the "mining right" entitles the grantee to extract every particle of the mineral, but the grant is net of the mineral in place, but only of the mineral rights and privileges.203

3. Species of Trade. The working of a mine under a bare "mining right" uniformly has been considered by courts of equity as a species of trade. 204 The legal relation existing between two or more persons interested in such a right is that of a qualified partnership and the remedies relating to a mining partnership are available for the assertion

or violation of any right arising out of it.205

4. Partition. It has been decided in California that a mere "mining right'' is not an estate which can be made the subject of a partition.²⁰⁶

CXV. Mining Title.

The term "mining title" as employed in Revised Statutes (§ 910) means the title which the miner obtains by his discovery and location. followed by a compliance with the statutory regulations to preserve the right of possession, and in possessory actions between persons the case shall be adjudged by the law of possession, though the paramount title is in the United States. 207

In a possessory action contemplated by the above section no greater proof of a right to recover can be required in a state court than would be required in a court of the United States, unless made so by a statute of the state.208

Monte Co., vs. Chandler, 158 Cal. 13, 109 Pac. 613.
 Gillis vs. Downey, 85 Fed. 486; see, also, Belk vs. Meagher, 104 U. S. 284; Del Monte Co., vs. Last Chance Co., supra (189); Price vs. McIntosh, 1 Alaska 292.
 Harris vs. Kellogg, 117 Cal. 499, 49 Pac. 708; see Haws vs. Victoria Copper Co., 160 U. S. 317.

²⁰¹ Hartman vs. Smith, 7 Mont. 28, 14 Pac. 648; see, also, S. P. Mines vs. Valcalda, 79 Fed. 890; Valcalda vs. S. P. Mines, 86 Fed. 93.

²⁰² Smith vs. Cooley, 65 Cal. 46, 2 Pac. 880; People vs. Bell, supra (199); see Last Chance Co. vs. Bunker Hill Co., 131 Fed. 579; Armstrong vs. Maryland Co., 67 W. Va. 589; 69 S. E. 195; see Carothers vs. Mills, supra (193).

In every private grant there passes by implication that which is reasonably necessary to the enjoyment of the thing granted. Washburn on Easements, (4th ed.) 49, 54. Hence a grant of the minerals under the surface of the land implies a right to mine them by the sinking of shafts or boring of tunnels and the removal of them through such openings. Himrod vs. Ft. Pitts Co., 220 Fed. 82.

²⁰³ Chandler vs. French, 73 W. Va. 658, 81 S. E. 825; see McGraw vs. Lakin, 67 W. Va. 385, 68 S. E. 27.

²⁰⁴ Smith vs. Cooley, supra. (202)

²⁰⁵ Id.

CXVI. Models.

A "model" is a facsimile in three dimensions—a reproduction in miniature of the underground workings of a mine, showing the shafts, tunnels, drifts, crosscuts, etc., in all their details. From its very nature, it does not fall within any definition of the word "map" and it is a misapplication of the term to call it a map, though it may far better serve the purpose in hand.209

CXVII. Monuments.

"Monuments" are permanent landmarks established for the purpose of indicating boundaries.210

CXVIII. Mucker.

A "mucker" is a miner whose duty it is to load ore in the heading on cars after the ore has been extracted by the miners.²¹¹

CXIX. Name of Lode.

The "name of the lode" is that by which it is designated in the notice of location, 212 and subsequent addition thereto is immaterial. 213 The same vein or lode may have different names in different mining locations.214

CXX. Negligence.

"Negligence" in a legal sense is a failure upon the part of a mine operator to observe for the protection of the interests of the miner that degree of care, precaution, and vigilance which the circumstances justify demand, whereby the miner suffers injury.²¹⁵

CXXI. Not Previously Known to Exist.

The words "not previously known to exist" refer to the time of the location and commencement of the tunnel and not to the respective times of the discoveries of the various veins in the tunnel.²¹⁶

CXXII. Obliterated Corner.

An "obliterated corner" is one where no visible evidence remains of the work of the original surveyor. 217

the work of the original surveyor. The practice of admitting maps, models and photographs in evidence in all proper cases should be encouraged. Such evidence usually clarifies some issue, and gives the jury and court a clearer comprehension of the physical facts than can be obtained from the testimony of witnesses. Kelly vs. City, 83 Wash, 55, 145 Pac. 57.

20 Thompson vs. Hill, 137 Ga. 308, 73 S. E. 640. Marking the boundaries of the surface claim as required by statute is one of the first steps towards a location. It serves a double purpose. It operates to determine the right of the claimant as between himself and the general government and to notify third persons of his right. Another seeking the benefits of the law, going upon the ground, is distinctly notified of the appropriation and can ascertain its boundaries. He may thus mark his own location with certainty, knowing that the boundaries of the other can not be changed so as to encroach on grounds duly appropriated prior to the change. The prevention of fraud by swinging or floating is one of the purposes served. Pollard vs. Shively, supra (69); Willeford vs. Bell. 5 Cal. Unrep. 679, 49 Pac. 6.

211 Republic Co. vs. Harris, 202 Ala. 344, 80 So. 426.

212 Philipotts vs. Blasdell, 8 New. 611.

213 Doe vs. Waterloo Co., 55 Fed. 11.

214 Philipotts vs. Blasdell, 8 new. (202) Ala. 344, 80 So. 426.

215 Darby vs. Shoop, 116 Va. 848, 83 S. E. 412. An oil well company is liable on the ground of negligence for using an old, worn, and unsafe "bull rope," and by reason of the defective condition of such rope an employee was injured, where it appears that he has no knowledge of the defective condition of the rope. Producers Oil Co. vs. Eaton, 44 Okla. 55, 143 Pac. 9. "First aid" as applied to an injured miner is defined to be immediate attention given to him with the object of arresting hemorrhage, relieving pain, and preserving life until the services of a physician can be obtained. Hunicke vs. Meramic Co., supra (26); see Cushman vs. Cloverland Co., supra (26).

CXXIII. Occupant.

An "occupant" of a tract of land, as the word ordinarily is used, is one who has the "use and possession" thereof, whether he resides upon it or not.218

CXXIV. Occupation.

The term "occupation" as used in the mining law, is equivalent to possession, and the right to locate is included in the right to occupy, and incident to a location is the right of possession; 219 but mere occupancy of the public lands and making improvements thereon gives no vested right therein as against a location 220 made in pursuance of

CXXV. Official Plat of Survey.

The expression in a patent "according to the official plat of the survey of the land returned to the General Land Office by the surveyorgeneral" refers to the description of the land as well as to the quantity conveyed.222

CXXVI. Oil Flotation.

The object of "oil flotation" is to separate metalliferous matter from gangue by means of oils and fatty acids that have a preferential affinity for such metalliferous matter, the principal feature of which is "agitating the mixture to cause the oil-coated mineral to form a froth. 223

CXXVII. Oral Agreement to Locate.

An agreement to locate need not be in writing. If a party, in pursuance of an "oral agreement to locate" at the expense of another, locates the claim in his own name, he holds the legal title to the ground in trust for the benefit of the party for whom the location was made. Such a party could, upon making the necessary proofs, compel the locator of the mining claim to convey the title to him, although the

²¹⁸ Johnson, L. D. 537.

²¹⁹ Tibbitts vs. Ah Tong, 4 Mont. 539, 2 Pac. 761; see, also, Collins vs. Bull, 73 Fed. 739; U. S. vs. Nelson, 27 Fed. Cas. 86; Ladda vs. Hawley, 57 Cal. 55; Hullins vs. Butte Co., 25 Mont. 531, 65 Pac. 1004. To constitute foundation of title, the occupancy must be with the intent or design to acquire the ownership of the thing occupied. No title to mineral land can be acquired by occupancy, unless for the purpose of mining or extracting the mineral. Burns vs. Clark, supra. (120)

Mere possession and occupancy of a mining claim, upon which there has been no discovery of mineral, are insufficient grounds for the lawful exclusion from the land of others who seek to make mineral discoveries and development thereon. It is only when such occupancy and possession are accompanied by diligent prosecution of work leading to discovery of mineral that the exclusion of others from the land is justified. Cole vs. Ralph, supra (1); Clark and Ohio Oil Co., 48 L. D. 634. See 111, supra.

work leading to discovery of mineral that the exclusion of others from the land is substified. Cole vs. Ralph, supra (**); Clark and Ohio Oil Co., 48 L. D. 634. See 111, supra.

220 Sparks vs. Pierce, 115 U. S. 408; Hays vs. U. S., 175 U. S. 260; S. P. R. Co. vs. Purcell, 77 Cal. 71, 18 Pac. 886; see Bonner vs. Meikle, 82 Fed. 697; Chism vs. Price, 54 Ark. 251.

221 Hopkins vs. Noyes, 4 Mont. 556, 2 Pac. 280. Possession is good against mere intruders, but it is not as against one who has complied with the mining laws. Garthe vs. Hart, 73 Cal. 543, 15 Pac. 93. See, also, Nevada Sierra Co. vs. Home Oil Co., 98 Fed. 673; Thallman vs. Thomas, 111 Fed. 277; Malone vs. Jackson, 137 Fed. 878; Miller vs. Chrisman, supra. (**s)

222 Sala vs. Crane, 31 Ida. 191, 170 Pac. 94; see, also, Niles vs. Cedar Point Club, 175 U. S. 300; Foss vs. Johnston, 158 Cal. 119, 110 Pac. 294; Round Mt. Co. vs. Round Mt. Co. supra (**20*); and see Schwartz vs. Dibblee, 51 Cal. A. 451, 197 Pac. 125.

223 Hyde vs. Minerals Sep. Co., 214 Fed. 109; see 242 U. S. 261; Minerals Sep. Co. vs. Miami Co., 237 Fed. 616; Id. 244 Fed. 752; Butte & S. Co. vs. Minerals Sep. Co. 250 Fed. 241, reversed in part and affirmed in part in 250 U. S. 336. See Id. 207 Fed. 956; Minerals Sep. Co. vs. British Syn., 27 R. P. C. 33. A number of patents have been granted in this and other countries, alming to make practical use of the property of oil and of oil mixed with acid in the treatment of ores, all of which consists of mixing finely crushed or powdered ore with water and oil and sometimes with acid added, and then in variously treating the mass or pulp thus formed so as to separate the oil when it becomes impregnated or loaded with the metal and metalliferous bearing particles from the valueless gangue, and from the resulting concentrate the minerals are recovered in various ways. Minerals Sep. Co. vs. Hyde, 242 U. S. 264.

agreement so to do was not in writing. Such an agreement is not within the statute of frauds.221

CXXVIII. Ore.

"Ore" is a compound of metal and other substance, 225 as oxygen, sulphur or arsenic, called its mineralizer, by which its properties are disguised or lost. The term is applied usually to a mineral from which the metal can profitably be extracted, but semetimes is extended also to nonmetallic minerals such as sulphur ore.226

CXXIX. Ore Dressing.

When the miner hoists his ore to the surface, the contained metal may be either in the native uncombined state, as, for example, native gold, native silver, native copper, or combined with other substances forming minerals of more or less complex composition, as, for example, telluride of gold, sulphide of silver, sulphide of copper. In both cases the valuable mineral is always associated with minerals of no value. The province of the ore dresser is to separate the "values" from the waste; for example, quartz, feldspar, calcite, by mechanical means, obtaining thereby "concentrates" and "tailings." The province of the metallurgist is to extract the pure metal from the concentrates by chemical means with or without the aid of heat.227

CXXX. Ore in Sight.

"Ore in sight" means ore-bearing rock so separated and blocked off by being worked around on two or more sides that it is subject to examination and measurement.²²⁸ Prospective purchasers have a right to rely upon statements as to the amount of ore in sight.²²⁹

CXXXI. Ore Personal Property.

"Ore," or other mineral product, becomes personal property when detached from the soil in which it is imbedded. 230

CXXXII. Other Valuable Deposits.

The term "other valuable deposits" includes nonmetalliferous as well as metalliferous deposits.231

CXXXIII. Ouster.

An entry by one on the land of another is an "ouster" of the legal possession arising from the title, or not, according to the intention with

supra. (225) Mudsill Co. vs. Watrous, supra (42); see Green vs. Turner, 86 Fed. 837. As to measurement of ore under water, see Ward vs. Eastwood, 3 Cal. A. 437; 86 Pac. 742.

229 Green vs. Turner, supra (225); see Southern Dev. Co. vs. Silva, 125 U. S. 247; see, also, Johnson vs. Withers, 9 Cal. A. 52, 98 Pac. 42.

230 Forbes vs. Gracey, supra (21); see Waskey vs. McNaught, 163 Fed. 929; Kelvin Co. vs. Copper Co., — Tex. C. A. — ; 203 S. W. 68.

221 Harry Lode, supra. (7)

8—37083

²²⁴ Book vs. Justice Co., supra. (13) The mining laws do not prohibit a person from initiating a location of a mining claim by an agent, as it is not necessary that he should personally act in taking up a mining claim, or in doing acts required to give evidence of an appropriation, or to perfect the appropriation. McCulloch vs. Murphy, 125 Fed. 149, see, also, U. S. vs. California Midway Oil Co., supra. (140)

225 Marvel vs. Merritt, 116 U. S. 11; Hemstead & Son. vs. Thomas, supra. (140)

Courts can not take judicial notice of what percentage of mineral can be extracted from a particular class of ore. This is a matter of proof in each particular case. Dixon vs. S. P. Co., 42 Nev. 73, 172 Pac. 370.

226 The Santa Clara, supra. (14)

227 The Santa Clara, supra. (14)

Courts will take judicial knowledge of the fact that processes of crushing, amalgamating, and cyaniding ores will not effect an extraction of 100 per cent of the metallic content. What will be a reasonable percentage of extraction will depend largely upon the process used and the character of the ore. Dixon vs. S. P. Co., supra. (225)

228 Mudsill Co. vs. Watrous. supra. (12) see Green vs. Turner, 86 Fed. 827, Ac. to.

which it is done. If made under claim and color of right, it is an ouster; otherwise it is a mere trespass. In legal language, the intention guides the entry and fixes its character. 232

CXXXIV. Outstroke and Instroke.

The term "outstroke" means the raising or removal of ore from a mine adjoining the demised premises through a shaft or opening on the latter. The term "instroke" means the right to raise or take ore from a leased mine through the shaft or tunnel of an adjoining mine. 233

CXXXV. Pedis Possessio,

The term "pedis possessio" means actual possession.²³⁴

CXXXVI. Photographs.

1. Where a plain picture or representation produced by the art of photography is verified as a correct representation of the locality in question, 235 it is admissible in evidence to enable the court or a jury to understand and apply the established facts to the particular case. Such photographic scenes are admissible as appropriate aids to the jury in applying evidence, whether it relates to things or places.²³⁶

2. Proving Photograph. Testimony that a "photograph" is a correct representation of the object sought to be shown is a sufficient foundation for its admission. Such testimony need not necessarily be given by the photographer who took or finished the "photograph" but may be given by any witness having sufficient knowledge of the object to say that the "photograph" is a faithful representation thereof.237

3. Common Practice. It is a common practice to use maps, models

and photographs to illustrate evidence. 238

CXXXVII. Pillars or Stumps.

"Pillars" or "stumps" are the natural supports left in the mine for the purpose of supporting the roof. 239

CXXXVIII. Placers.

The term "placers" as used in the Mining Act, means ground within defined boundaries chiefly valuable for its deposits, metallic or nonmetallic, in earth, sand or gravel, not in place, that is, in a loose state, upon or near the surface or occupying the bed of ancient rivers or valleys and may, in most instances, be collected by washing or amalga-

²²² Zerres vs. Vanina, 134 Fed. 614. When another enters upon a mining claim, asserting ownership therein, by virtue of an alleged superior title based upon a location, and exercises dominion over it to the exclusion of the rights of the owner this amounts to an ouster. Bramlett vs. Flick, 23 Mont, 95, 57 Pac. 869.

²³⁸ Percy Co. vs. Newman Co., 300 Fed. 142. The right to mine by instroke goes to the lessee by implication, but the right to mine by outstroke is excluded except where specially covenanted for in the lease, because in outstroke working, on the other hand, the lessee makes use of lessor's mine for a purpose not implied in the lease. Such a right can not be inferred. White on Mines and Mining Remedies, \$ 136; Stewart on Mines and Mining, pages 115, 116; McSwinney on Mines. (5th ed.), page 443; see, also, Barringer & Adams, Mines and Mining, page 578. See, generally, Sharum vs Whitehead Co., 223 Fed. 282; Schobert vs. Pittsburgh Co., 254 Ill. 474, 98 N. E. 945; Trustees vs. Lehigh Co., 236 Pa. St. 945, and see Bagley vs. Republic Co., 193 Ala. 219.

²⁴³ Southern Ry. Co. vs. Hall, 145 Ala. 224, 41 So. 136; Goldberg vs. Bruschi, smpra. (35) The actual possession of a mining claim is sufficient evidence of title as against a mere intruder. Campbell vs. Rankin, supra (35); see, also, Del Monte Co. vs. Last Chance Co., supra (35)

²⁵⁵ Delerich vs. Salt Lake Co., 14 Utah 137, 46 Pac. 656.

²⁶⁶ Harris vs. Seattle Co., 65 Wash. 27, 117 Pac. 601; Hassam vs. Safford, 82 Vt. 444, 74 Atl. 197.

²⁷⁷ Berkovitz vs. American River Co., 191 Cal. 195, 215 Pac. 675.

^{444, 71} Atl. 197.

237 Berkovitz vs. American River Co., 191 Cal. 195, 215 Pac. 675.

238 Delerich vs. Salt Lake Co., supra. (235)

238 Northeast Co. vs. Hunley. 163 Ky. 817, 174 S. W. 732.

mation. 240 In other words, the term "placers" includes all forms of deposit excepting veins or lodes of quartz or other rock in place.241

CXXXIX. Placer Location.

A "placer location" is a location of a tract of land for the mineralbearing or other valuable deposits upon or within it that are not found within lodes or veins in rock in place, and is a claim of a tract of land for the sake of the loose deposits on or near its surface.242

CXL. Placer Mining.

"Placer mining" simply is extracting the gold from placers, wherever situated—in dry channels and in channels for the time filled with water. It does not make the process any the less "placer mining" that the gold is found in deep channels, in navigable streams, or in estuaries or creeks and rivers where the sea ebbs and flows. 243

CXLI. Pop Shots.

A "pop shot" is a shot by which a boulder in a mine is broken up by placing a stick of dynamite on top of the boulder and exploding it. 244

CXLII. Preference.

The term "preference" is a familiar one under the public land laws and means "exclusive." 245

CXLIII. Proceedings.

The term "proceedings" is broader than the term "action" yet the term "proceedings" in the mining law is used in the sense of "action" and refers to the commencement of an action. And the term "proceedings" is used to enable a party to institute such proceedings under the different forms of actions allowed by the state and federal courts. 246

CXLIV. Process of Mining.

The "process of mining" is the prospecting or developing of ground by shaft, tunnel, or other opening, whether mineral is extracted at a profit or at all; by quarrying; or by dredging the bed or banks of a water-way for the purpose of obtaining mineral therefrom. 247

CXLV. Prospect Hole.

A "prospect hole" adds nothing to the value of the land but only tends to show its actual condition.248

²⁴⁰ U. S. vs. Iron Co., 128 U. S. 673; N. P. R. Co. vs. Soderberg, supra, (12) Clipper Co. vs. Eli Co., supra (10); Cole vs. Ralph, supra (1); Gregory vs. Pershbaker, 78 Cal. 109, 14 Pac. 401; Moxon vs. Wilkinson, 2 Mont. 421; Sullivan vs. Schultz, 22 Mont. 541, 57 Pac. 279.

241 Cosmos Co. vs. Gray Eagle Co., 104 Fed. 20, 112 Fed. 4, 190 U. S. 301; Webb vs. American Co., supra (138); Gregory vs. Pershbaker, supra. (240) 242 Webb vs. American Co., supra (138); see Clipper Co. vs. Eli Co., supra (140); Duffield vs. San Francisco Co., 205 Fed. 486; Gregory vs. Pershbaker, supra (240); Bay vs. Oklahoma Co., 13 Okla. 429; 73 Pac. 936. The rights conferred and the conditions upon which they are held are different in placer claims and lode claims. U. S. vs. Iron Co., supra, (240)

243 Ball vs. Tolman, supra, (117) See, also, Richen vs. Davis, 76 Or. 311, 148 Pac. 1130.

244 Batesel vs. American Zinc Co., 190 Mo. A. 231, 176 Sev. 447.

245 Morrison, 36 L. D. 128; see U. S. vs. Forrester, 211 U. S. 403.

246 Mars vs. Oro Fino Co., 7 S. D. 617, 65 N. W. 19, see Chambers vs. Harrington, supra (130); Cronin vs. Bear Creek Co., 3 Ida, 614, 32 Pac. 204; Mattingly vs. Lewisohn, 13 Mont. 508, 19 Pac. 310; Golden Fleece Co. vs. Cable Con. Co., 12 Nev. 312.

Nev. 312.

247 Johnson vs. California Lustral Co., supra. (190)

218 Tyson Creek Co. vs. Empire Mill Co., 31 Ida. 580, 174 Pac. 1006. For the value of a prospect hole for oil, caused to be drilled by a lessee of oil and gas lands, but not completed, see North Healdton Co. vs. Skelley, ——Okla. ——, 158 Pac. 1182.

CXLVI. Prospecting and Mining.

"Prospecting" and "mining" are generic terms which include the whole mode of obtaining metals and minerals.²⁴⁹

CXLVII. Protestant.

A person who has filed no "adverse claim" during the period of publication and comes forward and presents objections to the granting of a patent is a "protestant." 250

CXLVIII. Provisional Locations.

A location can not depend for its validity upon the subsequent forfeiture or abandonment of the claim by the present claimant.²⁵¹

CXLIX, Public Domain.

The term "public domain" is equivalent to the term "public land." 252

CL. Public Land.

The term "public land" as used in the legislation of congress means such lands as are subject to appropriation as a mining claim 253 or subject to sale, or other disposition, under the general laws. 254

CLI. Public Mineral Land.

"Public mineral land" is land belonging to the United States containing a deposit of mineral in some form, metalliferous or nonmetalliferous, in quantity and quality sufficient to justify expenditures in the effort to extract it and subject to occupation and purchase under the mining laws. 255

CLII. Public Land and Public Use.

There is a clear distinction between public lands and lands that have been severed from the public domain and reserved from sale or other disposition under general laws. Such reservation severs the land from the mass of the public domain and appropriates it to a "public use." 256

CLIII. Pusher-Jigger Boss.

"Pusher" or "jigger boss" is a term used in mining parlance to designate one who is engaged for the purpose of encouraging or hastening the miners.²⁵⁷

²⁴⁰ Williams vs. Toledo Co., 25 Or. 426, 36 Pac. 426; see Bishop vs. Baisley,

²⁵⁰ Smuggler Co. vs. Trueworthy Lode Claim, 19 L. D. 356; see Tilden vs. Intervenor

²⁶⁰ Smuggler Co. vs. Trueworthy Lode Claim, 19 L. D. 356; see Tilden vs. Intervenor Co., 1 L. D. 572.

²⁵¹ Mason vs. Washington-Butte Co., 214 Fed. 32; Rooney vs. Barnette, 200 Fed. 700; see, also, Slavonian Co. vs. Perasich, 7 Fed. 232.

²⁵² Barker vs. Harvey, 181 U. S. 490.

²⁵³ S U. S. Comp. St., p. 5414, \$4614. See Erhardt vs. Boaro, supra ⁽⁴⁾; Deffebach vs. Hawke, supra ⁽¹²⁾; see, also, South End Co. vs. Tinney, supra. ⁽¹⁶⁾ Land not known to be mineral is not "public mineral land" within the meaning of the statute. Smith vs. Hill, 89 Cal. 129, 26 Pac. 644.

²⁶⁴ Newhall vs. Sanger, 92 U. S. 761; Barden vs. N. P. R. Co., 154 U. S. 288; U. P. R. Co. vs. Harris, 215 U. S. 388; McFadden vs. Mt. View Co., 97 Fed. 670; U. S. vs. Blendauer, 122 Fed. 703.

In the legislation concerning the public lands it has been the practice of congress to make a distinction between mineral lands and other lands, to deal with them along different lines and to withhold mineral lands from disposal save under the laws specially including them, U. S. vs. Sweet, 245 U. S. 567.

²⁵⁵ Pacific Coast Co. vs. N. P. R. Co., supra ⁽⁶⁰⁾; see Deffebach vs. Hawke, supra ⁽⁷²⁾; Alford vs. Barnum, 45 Cal. 482. Federal statutes opening mineral lands to entry apply to only such lands as the United States has indicated are held for disposal under land laws. Oklahoma vs. Texas, 258 U. S. 574.

²⁶⁰ U. S. vs. Tygh Co., 76 Fed. 693.

²⁶⁷ Ryan vs. Manhattan Co., 38 Nev. 92, 145 Pac. 908.

CLIV. Quarry.

A "quarry" in its proper significance is a "stone mine" and may be located as a placer claim. 259 It is distinguished from a mine in the fact that usually it is open at the top and front, and in the ordinary acceptation of the term, in the character of the material extracted.260

CLV. Real Property.

The term "real property" includes mining claims, 261 dumps, 262 water rights.263 and ditches.264

CLVI. Relinguishment.

A "relinquishment" turns the land back to the United States, and with it every right, possessory or otherwise, that the relinquisher enjoyed.265

CLVII. Rule of Approximation.

The "rule of approximation" now is applicable to placer mining locations and entries upon surveyed lands, to be applied on the basis of ten-acre legal subdivisions.266

CLVIII. Saddle.

A "saddle" is a peculiar formation of sand slate found in shale or sand rock and may be surrounded by soapstone. The under or exposed side of a saddle looks like natural rock, but its upper side is smooth, having no particular bond with the sand rock with which it is embedded, and is liable to fall out of its place; a fall, however, producing no other derangement of the surrounding parts of the room from which it falls.267

CLIX. Salines.

Salt mines of rock salt, mineral springs, salt springs, salt beds and salt rock all come within the meaning of the general term "salines."

CLX. Salting.

"Salting" consists in placing, usually surreptitiously, valuable mineral from a foreign source in such form and place within the claim as the characteristics of the latter may require, or, in like manner,

²⁵⁸ In re Kelso, 147 Cal. 609, 82 Pac. 241; see Quincy Co., 147 Fed. 279; see, generally, Nephi Co. vs. Juab County, 33 Utah 114, 93 Pac. 53.

²⁵⁹ Pacific Coast Co. vs. N. P. R. Co., supra ⁽⁶⁰⁾; Meiklejohn vs. Hyde, 42 L. D. 147; Freezer vs. Sweeney, 8 Mont. 233, 21 Pac. 20; see Clark vs. Ervin, 17 L. D. 550. See, generally, Burdick vs. Dillon, 144 Fed. 741, U. S. vs. Ohio Oii Co., 240 Fed. 996.

²⁵⁰ In re Kelso, supra ⁽²⁵⁾; see, generally, Beil vs. Wilson, L. R. 1 Ch. 309; Davill vs. Roper, 24 L. J. Ch. 779; Glasgow vs. Fairie, supra ⁽¹⁶⁰⁾; American Onyx Co., 42 L. D. 417; Marvel vs. Merritt, 116 U. S. 11, Heysradt vs. Delaware Co., 151 Fed. 321; J. M. Guffey Co. vs. Murrel, supra ⁽¹⁶⁰⁾; Shaw vs. Wallace, 25 N. J. Law 462; Miller vs. Chester Co., supra ⁽⁶⁰⁾; Rutledge vs. Kress, 17 Super. Ct. 495; Murray vs. Allred. supra, ⁽¹⁵⁰⁾

^{462;} Miller vs. Chester Co., supra (**); Shaw vs. Wallace, 25 N. J. Law 462; Miller vs. Chester Co., supra (**); Rutledge vs. Kress, 17 Super. Ct. 495; Murray vs. Allred, supra (**); Rutledge vs. Kress, 17 Super. Ct. 495; Murray vs. Allred, supra (**); Steinfeld vs. Ones vs. Peck, supra (**) and see Van Ness vs. Rooney, 160 Cal. 131, 116 Pac. 392.

202 Savage vs. Nixon, supra (); Steinfeld vs. Omega Co., supra, (**) asee, also, Manson vs. Dayton, 153 Fed. 263.

**203 Bree vs. Wheeler, 4 Cal. A. 109, 61 Pac. 782.

**204 Gest vs. Packwood, 34 Fed. 368; Smith vs. O'Hara, 43 Cal. 371; Burnham vs. Freeman, 11 Colo. 601, 17. Pac. 761.

**205 Moss vs. Dowman, 176 U. S. 413; Robinson vs. Lundrigan, 227 U. S. 180; Kendall vs. Bunnell, 56 Cal. A. 112, 205 Pac. 78. For insufficient form of a relinquishment see Bojorques vs. Heihm, 50 L. D. 165.

**205 Lehigh Valley Co. vs. Wasko, 231 Fed. 12, 48.

206 Southwestern Co., 14 L. D. 603. The term "mineral lands" is one of broader significance than the words "lands on which are situated any known salines or mines," and the former refers to a class of lands rather than to specified tracts easily ascertainable, not only by the Land Department, but by the applicants themselves. Old Dominion Co. vs. Haverly, 11 Ariz, 254, 90 Pac. 333; see Cosmos Co. vs. Gray Eagle Co., supra. ()

tampering with the samples of ore or mineral taken therefrom or with the assays thereof, or the amalgam or other matter in the mill or other reduction works, with the intent and for the purpose to thereby give increased apparent, but misleading and inflated value to the property, which is the subject of the option or contract of sale thereof and so induce its sale at a price greater than its mineral value warrants.269

CLXI. Salt Lick.

A "salt lick" is so-called in the western country from the fact that deer and other wild animals resort to it, and lick or drink the brackish water. And in this respect no distinction is perceived between a "lick" as frequently used and a "salt spring." 270

CLXII. Safe Appliances.

The term "safe" when used in respect to appliances to be furnished by an employer to an employee means "reasonably safe," and "reasonably safe" means such tools as are in general use among employers of ordinary caution and prudence in the same line of business under the same circumstances. 271

CLXIII. Safe Place.

The rule that a mine operator or other employer must exercise reasonable care to furnish a miner or an employee with a "safe place" in which to work does not apply where the miner or employee is himself creating the place in which he works, or where the danger was such as was created by the miner or employee in the progress of his work.²⁷²

CLXIV. Scrip.

1. "Scrip," sometimes called "indemnity certificates" and sometimes "land warrants," is a document created by legislative enactment, whereby the holder thereof is entitled to acquire public nonmineral land, in the certain quantity therein named upon its surrender to the officers of the land office for the district of lands subject to sale and wherein the selected lands may lie, or as otherwise provided by the law authorizing its creation.²⁷³

2. Selection. The "scrip" may be laid upon unoccupied surveyed or unsurveyed nonmineral land 274 as the terms of the particular act providing for its issuance may permit. When the entry is made the land is withdrawn from the public domain.275

3. Assignment and Sale. The "scrip," generally, is subject to assignment and sale in the open market. Its price per acre is governed by the law of supply and demand.

4. Guarantee. The seller of the "scrip" should, properly, guarantee its acceptance by the government, as the doctrine of "bona fide purchaser" does not apply to one who purchases the "scrip." 276

²⁶⁰ See Schamel on Mining Law, page 316; Mudsill Co. vs. Watrous, supra, (42) See, also, Southern Development Co. vs. Silva, supra (220); Cook vs. Johnson, 3 Alaska 519; Healey vs. Rupp, supra, (42) 270 Indiana vs. Miller, 13 Fed. Cas. 7022; see, also, New Mexico, 35 L. D. 5, 271 Lively vs. American Co., 137 Tenn. 261, 191 S. W. 977. 272 New Hughes Co. vs. Gray, 173 Ky. 337, 191 S. W. 79; see, also, Big Vein Co. vs. Repass, 238 Fed. 334. 272 See Opinion, 28 L. D. 172 273 Weise, 2 C. L. O. 130; Valle, 2 C. L. O. 178; Letter, 3 C. L. O. 83; see Burgess, 20 L. D. 502; Florida, 45 L. D. 469; Van Dyke Co. vs. Malott, 50 L. D. 326; Martin, 18 L. D. 277. 275 James vs. Germania Co., 107 Fed. 597. 276 Pettigrew, 2 L. D. 598; see James vs. Germania Co., supra (275); Van Dyke Co. vs. Malott, supra, (274) For case involving "scrippers" and oil locators, see McLemore vs. Express Co., supra, (274)

Express Co., supra. 07

CLXV. Seam.

In geology a thin layer or stratum of rock is called a "seam." The term is also applied to coal. "Vein or coal," "coal bed" and "coal seam' are equivalent terms.277

CLXVI. Shift.

The word "shift" means a set of workmen who work in turn with other shifts, as a night shift.278 It means, also, a day's work.279

CLXVII. Shift Boss.

The term "shift boss" means a master workman who directs the work of the set of men engaged upon a particular shift; that is, the set of workmen who work in turns with other sets.²⁸⁰

CLXVIII. Shoestring Location.

A "shoestring location" is a location of a long and narrow strip of mineral land.281

CLXIX. Skips.

"Skips" or cars are operated from the surface by cables attached to a drum which in turn is operated by an engine. The cars or "skips" are used by the employees of the mine owner to enter and leave the mine and also for the lowering of supplies into and the taking of ore from the mine.282

CLXX. Slag.

"Slag" is a refuse from metallic ores after being smelted.²⁸³

CLXXI. Slope.

The term "slope" in a mining statute or in mining parlance means an inclined way, passage, or opening used for the same purpose as a shaft and is sometimes used as embracing the main haulage passageway, whether inclined or level 284

²⁷⁷ Chapman vs. Mill Creek Co., 54 W. Va. 193, 46 S. E. 263. The discovery of seams containing mineral-bearing rock similar in character to seams or veins of mineral matter that had induced other miners to locate claims in the same district, and which by development were found to be a part of a well-defined lode or vein containing ore of great value, constitutes a discovery. Jefferson-Montana Co., 41 L. D. 320 supra (40); see Harper vs. Hill, supra, (40)

A discovery made in running a tunnel where there were small seams of iron oxide, quartz, and small quantities of carbonate of lead, and where the indications were of a character which the miners of that district would follow in the expectation of finding ore, and where the rock in such seams was different from the country rock, and where such seams were similar in character to the seams or veins of mineral matter that has induced other miners to locate claims in the same district, is a sufficient discovery to justify a belief in the existence of a lode or vein of great value, and to show that the location was made in good faith and not upon a conjectural or imaginary existence of a vein or lode, which can not be permitted. Shoshone Co, vs. Rutter, sunra (44); see King vs. Amy Co., 152 U. S. 227; Lange vs. Robinsin, 148 Fed. 802; Jefferson-Montana Co., 41 L. D. 322. In any case it may be an open question whether a location includes lands valuable for minerals. or whether it is based upon a barren seam or fissure. Montana Co. vs. Migeon, 68 Fed. 814; Rough Rider Claims, 41 L. D. 253; see Madison vs. Octave Oil Co., supra, (42) 99 Pac, 176.

⁹⁹ Pac. 176.

218 Johnson vs. Butte & S. Co., supra. (53)

219 Haney vs. Texas Co., — Tex. C. A. —, 207 S. W. 375.

280 Johnson vs. Butte & S., supra. (52)

281 Hanson vs. Craig, 170 Fed. 65, Snowflake Fraction, 37 L. D. 250. See Dripps vs. Allison's Co. 45 Cal. A. 95, 187 Pac. 448.

282 Moreno vs. New Guadalupe Co., 35 Cal. A. 744, 170 Pac. 1088.

283 Baltimore Co. vs. Carnegie Co., 251 Fed. 685. The term "tailings" has been construed as including slag. Boston Co. vs. Montana Co., 121 Fed. 526. The owner of material like slag, the refuse of mineral deposit dug from the earth, run through a mill, and then dumped upon the surface of contiguous land, may be treated and dealt with as mere personalty, which the owner may sell and deliver as any other personal property susceptible of manual delivery. Manson vs. Dayton, supra. (202)

284 Roberts vs. Tennessee Co., 255 Fed. 471.

CLXXII. Smelter Returns.

The phrase "smelter returns" in a contract means returns from the ore, less the smelting charges, without deducting transportation charges.285

CLXXIII. Smelting.

"Smelting" by its derivation is synonymous with "melting." When metallic ores are exposed to heat, and such reagents as develop the metal, it is called "smelting" in contradistinction from the mere application of heat, causing the ore to become fluid, which is called "smelting." 286

CLXXIV. Stabber.

The term "stabber" is employed in the work of tubing oil and gas wells to the person whose duty it is to guide the joints suspended by a rope from the derrick to connect with other joints, placed in the well. 287

CLXXV. Sludge.

"Sludge" is a murky colored sediment flowing from the operations of a lead and zinc mining plant.288

CLXXVI. Stake.

A "stake" is not a post. The latter signifies more permanence, and to stick it in the ground requires more effort and outlay than to drive down a stake. It suggests larger proportions, is more readily seen than a stake.289

CLXXVII. Stope.

The term "stope" is defined as the working above and below a level where the mass of the orebody is broken—also an excavation for the extraction of ore. A stope is the very antithesis of a shaft, tunnel, drift, winze or other similar excavation in a mine. 290

CITIT, WINZE OF OTHER SIMILAR EXCAVATION IN a MINE.

285 Frank vs. Bauer, 19 Colo. A. 445, 75 Pac. 930; see, also, Guild Co. vs. Mason, 115 Cal. 95, 46 Pac. 901; Con. Karsas Co. vs. Gonzales, 50 Tex. A. 79, 109 S. W. 946; Blanck vs. Pioneer Co., 98 Wash. 261, 159 Pac. 1077.

296 Lowrey vs. Cowles Co., 68 Fed. 369, Id. 79 Fed. 331.

The business of smelting is a part of the operation of mining, although it may be distinct from that of digging or mining the ore. U. S. vs. Gratiot, 39 U. S. 538; U. S. vs. United Verde Co., 196 U. S. 212; U. S. vs. Richmond Co., 40 Fed. 415.

285 Dickensheet vs. Chouteau Co., 200 Mo. A. 150, 202 S. W. 625.

289 U. S. vs. Sherman, supra. (348)

See Upton vs. Larkin, 7 Mont. 449, 17 Pac. 728. Parol evidence in case of uncertain and disputed boundaries is not admissible to show a stump as a monument where the record calls for a post. Pollard vs. Shively, supra (369); Duncan vs. Eagle Rock Co., supra (651)

290 Creede Co. vs. Hawman, 33 Colo. A. 125, 127 Pac. 926; Mesich vs. Tamarack Co., 184 Mich. 363, 151 N. W. 565. In Fisher vs. Central Co., 156 Mo. 479, 56 S. W. 1107, the word "stope" is defined to mean "the excavation made in a mine to remove the ore which has been rendered accessible by the shaft or drift." Mr. Schamel, in his work on Mining Law (page 19), says: "The idea of a stope implies that the excavation is temporary and only kept open until the ore is removed, after which it is allowed to cave in or become filled with waste rock, etc., while shafts or drifts are permanent openings for passing to and from the place where mining is being done and for transporting the mineral."

"Overhand stoping" is a method of working out the contents of a vein by advancing from below upward, the miner being thus always helped by gravity. It is the method most commonly employed. That part of the material thrown down which is worth saving is raised to the surface, and the refuse rock (attle or deads) resting on the stulls remains in the excavation, helping to support the walls of the mine, a

out. Cent. Dict.

A "filled stope" may be defined as one where waste rock is left on the floor of the stope, thus raising the floor as the work proceeds. Creede Co. vs. Hawman, suma.

CLXXVIII, Strikes.

1. A "strike" is a combined effort among workmen to compel the employer to the concession of a certain demand by preventing the conduct of his business until compliance with the demand.²⁹¹

2. Strikes Lawful. A "strike" is lawful. It only becomes unlawful when the means employed to carry it out are unlawful, or when it

maliciously is originated to attain an unlawful end.292

- 3. Right of Employees to Strike. An employee, or any number of employees, in the absence of a contract to work a definite time, has a right to quit the service of the employer without any reason, or for any reason he may regard satisfactory to himself. The employees of a mining company have a right to protest to the employer against the employment or retention of a nonunion employee and to make the discharge of such nonunion employee a condition to their continuation in his employment. That unless such nonunion employee is discharged the union employees will strike, or the equivalent, will simultaneously cease to work. If, under such circumstances, the nonunion employee is discharged by the common employer he has no cause of action against either the union as an organization or the members thereof as individuals.293
- 4. Labor Unions. The growth and necessities of the great labor organizations have brought affirmative legal legislation of their existence and usefulness and provision for their protection, which their members have found it necessary. Their right to maintain "strikes," when they do not violate the law or the rights of others, has been declared.294
- 5. Acts Enjoined. When officers and agents of the United Mine Workers of America attempt to reorganize and unionize a mine the operator is entitled to an injunction restraining them from acts and conduct; (1) Interfering or attempting to interfere with his miners for the purpose of unionizing the mine without his consent, by representing to the miners employed that they will suffer, or are likely to suffer some loss or trouble in continuing in or in entering the employment of the operator by reason of his not recognizing the union or because he runs a nonunion mine; (2) interfering or attempting to interfere with the operator's miners employed for the purpose of union-

²⁸¹ Farmers Co. vs. N. P. R. Co., 60 Fed. 802; see, also, Longshore Co. vs. Howell, 26 Or. 527. The term "legal strike" has been said to mean a strike declared in pursuance of the rules of the order. Toledo Co. vs. Penn. Co., 54 Fed. 733. The interpuption of operations by strikes is provided for in §87 (2 Supp. U. S. Comp. St., p. 1406, § 46404ee) and § 11 (Id. p. 1408, § 46404ee) of the Land Leasing Act.

²⁰² Kolley vs. Robinson, 187 Fed. 415. To instigate a sympathetic strike in aid of a boycott is not permissible under the Clayton Act, prohibiting injunctions in certain cases. Pacific Co. vs. International Typo. Union, 125 Wash. 273, 216 Pac. 358. The right of an employee to strike does not give an outsider a right to instigate a strike. Montgomery vs. Pacific Electric Co., 293 Fed. 683.

²⁰³ Roddy vs. United Mine Workers of America, 41 Okla. 621, 139 Pac. 126; see, also, Mitchell vs. Hitchman, 245 U. S. 229; Bittner vs. West Virginia Co., 214 Fed. 717: It is the right of every man to engage to work for or to deal with any man or class of men as he sees fit, whatever his motive or whatever the resulting injury, without being held in any way accountable therefor. Parkinson vs. Building Trades, 154 Cal. 599, 98 Pac. 1027; Pierce vs. Stablemen's Union, 156 Cal. 75, 103 Pac. 2.4. These rights may be exercised in association with others so long as they have 10 unlawful object in view. Overland Co. vs. Union Lith. Co., 57 Cal. A. 366, 207 Pac. 412.

unlawful object in view. Overland Co. vs. Union Little. Co., 57 Cal. A. 500, 250. Pac. 412.

200 United Mine Workers of America vs. Coronado Co., 259 U. S. 385.

Union miners have a right by peaceful methods to persuade other miners not to work in a non-union mine; but they have no right to attempt such result by violence or intimidation. A mining company is within its rights in refusing to employ union men and in discharging those who join a union, and the company is entitled to protection against unlawful invasions of such rights. Tosh vs. West Kentucky Co., 252 Fed. 44. For a discussion of the relative rights of mine owners and miners, see Mitchell vs. Hitchman Co., 214 Fed. 715; Bittner vs. West Virginia Co., supra (220)

izing the mine without his consent and in aid of such purpose knowingly and wilfully bringing about the breaking by the miners of contracts of service known to exist with the employer and present and future employees; (3) knowingly and wilfully enticing the operator's employees to leave his service on the ground that he does not recognize the United Mine Workers of America or runs a nonunion mine; (4) interfering or attempting to interfere with the operator's employees so as knowingly and wilfully to bring about the breaking by the employees of their contracts of service known to exist, especially from knowingly and wilfully enticing the employees to leave the employer's service without his consent; (5) trespassing on or entering upon the grounds and premises of the employer or his mine for the purpose of interfering therewith or hindering or obstructing the business or with the purpose of compelling or inducing by force, intimidation, violence, or abusive language or persuasion, any of the employer's employees to refuse or to fail to perform their dufies as such; (6) compelling or inducing or attempting to compel or induce by threats, intimidation, or abuse or violent language, any of the employer's employees to leave his service or to fail or refuse to perform their duties as such employees or compelling or attempting to compel by like means any person desiring to seek employment at the employer's mine and works from so accepting employment therein. 295

6. Persons Bound by Injunction. An injunction is binding not only upon the particular persons named, but upon all persons participating in the acts charged and mentioned therein who have actual knowledge of the injunction; and all such persons may properly be punished as

for contempt of court in violating the injunction 296

CLXXIX. Superintendent.

A "superintendent" is one who superintends; a director; an overseer.297

CLXXX. System.

The term "system" or "general system of work" means simply this: that the work as it is commenced on the ground is such that, if continued, will lead to a discovery and development of the veins or orebodies that are supposed to be in the claim, or, if these are known, that the work will facilitate the extraction of the ores and mineral.²⁹⁸

²⁰⁵ Mitchell vs. Hitchman Co., $supra.^{(205)}$ A restraining order against picketing will advise labor's earnest advocates that the law does not look with favor on an enforced discussion of the merits of the issue between individuals who wish to work, and the groups of those who do not, under conditions which subject the individuals to work to a severe test of their nerve and physical strength and courage. American Foundries vs. Tri-State Council, 257 U. S. 206. The "Clayton Act." (\$20) is discussed and compared with English Trades Dispute Act of 1906, from which said statute was taken, in Great Northern Ry. Co. vs. Brosseau, 286 Fed. 414. Where an injunction against certain union miners has been issued, restraining violence against the property and non-union employees of a mining company, language or conduct intended to incite others to violence and to a violation of the court's order constitutes a punishable contempt. U. S. vs. Colorado, 216 Fed. 654. For a case involving "boycotting" see Truax vs. Corrigan, 257 U. S. 312 rev'g 20 20 Ariz. 7. See, also, Duplex Co. vs. Deering, 254 U. S. 443; also 16 A. L. R. 196.

For a discussion of state laws requiring corporations to issue to employees when discharged from or voluntarily leaving their service, letters setting forth the nature of the services rendered by such employees, and its duration, with a true statement of the cause of discharge or leaving, see Prudential Co. vs. Cheek, 259 U. S. 530; Chicago Co. vs. P. R. Co., 259 U. S. 548; Tosh vs. Kentucky Co., supra. (4) 208 Nevada Ex. Co. vs. Spriggs, 41 Utah 181, 124 Pac. 770.

CLXXXI. Taking Timber Necessary to Support Their Improvements.

The term "taking timber necessary to support their improvements" applied to a miner means all the timber he might need to make the working of his mine possible.299

CLXXXII. This Vein.

A notice claiming a location upon "this vein" has only one meaning,³⁰⁰ It raises an inference that the notice was posted upon or in close proximity to a vein or lode; 301 although, as a fact, no vein or lode then was exposed. 302

CLXXXIII. Timbering.

By "timbering" is meant the protecting against falls of roof formation of a mine, by means of horizontal timbers or caps extending across the passageway just under the roof, the ends of such timbers resting upon the vertical timbers or posts. 303

CLXXXIV. Tool Nipper.

"Tool nipper" is a term applied to a person whose duty it is to carry powder and sharpen drills and tools used in a mine down to the various levels of the mine and to bring back such tools and drills as have been dulled by use to the surface. 304

CLXXXV. Top and Apex.

The words "top" and "apex" as applied to mineral veins were not a part of the miner's terminology prior to the adoption of the federal mining law, but were words used by legislators to convey the intent of the formulators of that law. 305

CLXXXVI. To the Same Extent.

The clause "to the same extent as if discovered from the surface" is used in section 2323 Revised Statutes in its natural and customary sense, and it measures the extent, the distance along the vein or lode to which the right of possession given by the statute extends, and not to the general benefits conferred by the discovery. 306

CLXXXVII, Trap.

"Trap" or "trap rock," a general name for dark, fine-grained rock, found in broken-up fragments within a limited area, which is particularly suitable and can be profitably marketed for ballast, is, when the land within which it is contained is chiefly valuable for such, a valuable

³⁰⁶ Enterprise Co. vs. Rico-Aspen Co., 66 Fed. 204; Ellet vs. Campbell, 18 Colo. 526, 33 Pac. 521; Id. 167 U. S. 119.

²⁰⁰ Instructions, 1 L. D. 602; see Teller vs. U. S., 113 Fed. 280; and see, Benson Co. vs. Alta Co., supra (103); U. S. vs. Rizzinelli, 182 Fed. 681.
200 Phillpotts vs. Blasdell, supra (212); see Daggett vs. Yreka Co., supra.(151) See East Tintic Co., 41 L. D. 256.
301 Daggett vs. Yreka Co., supra (105); see Willeford vs. Bell, supra (210); 49 Pac. 6; Daggett vs. Yreka Co., supra (151)
302 Book vs. Justice Co., supra (151)
303 Eagle Co. vs. Patrick, 161 Ky. 333, 170 S. W. 961.
304 Moreno vs. New Guadalupe Co., supra (220)
305 Jim Butler Co. vs. West End Co., supra (230)
306 A controversy as to what is the top or apex of a vein or lode is a question of fact to be determined by evidence, and not one of law, as these are not scientific expressions, but words in common use. Blue Bird Co. vs. Largey, 49 Fed. 291. The question of the ownership of a vein or lode depends upon whether the top and apex of such vein or lode is in one place or another. Stevens vs. Gill, 23 Fed. Cas. 13; see Stevens vs. Williams, 23 Fed. Cas. 40, and see Iron Co. vs. Cheesman, 116 U. S. 533; King vs. Amy Co., 152 U. S. 227; Black vs. Elkhorn Co., supra. (1)
308 Enterprise Co. vs. Rico-Aspen Co., 66 Fed. 204; Ellet vs. Campbell, 18 Colo. 526, 33 Pac. 521; Id. 167 U. S. 119. vs. Elknorn 300 Enterprise

mineral deposit subject to appropriation and patent under the placermining laws.307

CLXXXVIII. Trespass.

An intrusion upon land occupied by another for the purpose of locating a mining claim is but a naked trespass and initiates no right; 308 although the occupant has no other valid title than posession. 309

CLXXXIX. Tungsten.

"Tungsten," in the metallic state, is one of the rare elements, occurring neither in nature nor the arts. In the pure metallic state the metal is considered only as a curiosity. Metallic tungsten is obtained by reducing. It is inorganic. It has a definite chemical composition. Its properties as a metal are disguised and lost in its mineralizer compound. Tungsten ore has none of the characteristics of metals. It has neither elasticity, ductibility, malleability, resonance, nor luster. It is aptly described by the term "mineral crude." 310

CXC. Tunnel Claim.

A "tunnel claim" is not a mining claim; it only is a means of exploration and discovery. When a lode or vein is discovered in the tunnel the tunnel owner is called upon to make a location of the ground containing the vein or lode and thus create a mining claim. 311

CXCI. Tunnel Right.

A grant of a "tunnel right" through a specific piece of ground is a right to enter upon and occupy the ground for the purpose of prosecuting the work in the tunnel, and to extract therefrom waste rock or earth necessary to complete the running of the tunnel, and making such use thereof, after completion, as may be necessary to work the mining ground or lode owned by the party running the tunnel. By implication the grant of such a right carries with it every incident and appurtenant thereto, including the right to dump the waste rock at the mouth of the tunnel on the land owned by the grantor at the time of the conveyance of the tunnel right; such right or easement being necessary for the full and free enjoyment of the tunnel right.³¹²

CXCII, Tunnel Sites.

There is no distinction between a tunnel claim under which a tunnel is run for the development of veins or lodes already located, and one pursuant to which a tunnel is projected for blind veins or lodes. 313

³⁰⁷ Day, supra, ⁽⁸⁸⁾ citing and applying the cases of N. P. R. Co. vs. Soderberg supra ⁽⁷²⁾; Castle vs. Womble, 19 L. D. 455; Pacific Coast Co. vs. N. P. R. Co., supra, ⁽⁹⁰⁾ and Cataract Co., 43 L. D. 248, and distinguishing the cases of Zimmerman vs. Brunson, 39 L. D. 340; Stanislaus Co., 41 L. D. 655.
³⁰⁸ Atherton vs. Fowler, 96 U. S. 513; Nevada Sierra Co. vs. Home Oil Co., supra ⁽²²¹⁾; see, also, Campbell vs. Rankin supra ⁽¹⁸⁷⁾; Haws vs. Victoria Copper Co.,

SHUTA, (208)

^{**}Sapra** (2005)**
Sapra (20

CXCIII. Unavoidable Casualties.

The term "unavoidable casualties" means that which could not be avoided by the exercise of reasonable diligence and skill.³¹⁴

CXCIV. Unoccupied and Unappropriated Land.

The term "unoccupied" and "unappropriated" refer to land that is not in the possession of one who claims the right of possession thereto by virtue of a compliance with the law.315

CXCV. Usual Mining Privileges.

By the term "usual mining privileges" in a deed the grantee has and may enjoy the right to go upon the land and explore for, open and operate mines, take out and sell the product, and do all things incident to that work.316

CXCVI. Vacant Land.

Land is not "vacant" when occupied as a mining claim without discovery by one who is diligently prospecting it for minerals which it may contain.317

CXCVII. Veins and Lodes.

The fact that the terms "veins" and "lodes" have been used by congress in connection with each other is suggestive that it was intended to avoid any limitation in the application of the mining acts which might be imposed by a scientific definition of either term. 318

CXCVIII, Wash.

The term "wash" belongs neither to the terminology of geology nor of law. The wash of a stream is the sandy, rocky, gravelly, boulderbestrewn part of a river bottom. The "cone" of the stream is not synonymous with "wash" of the stream; nor conterminous with it. 319

CXCIX. Water Rights.

When one has legally acquired a "water right," he has a property right therein that can not be taken from him for public or private use except by due process of law and upon just compensation being paid therefor. One who has acquired a legal water right can only be deprived of it by his voluntary act in conveying it to another, by abandonment, forfeiture under some statute, or by operation of law. A "water right" is an independent right and is not a servitude upon some other thing. and is an incorporeal hereditament, being neither tangible nor visible. 320

CC. Waste.

"Waste," is the doing of those acts which cause lasting damage to the freehold or inheritance or the neglect or omission to do those acts

s14 Bennett vs. Howard, 175 Ky. 797, 195 S. W. 118.
s15 Conn vs. Oberto, 32 Colo. 313, 76 Pac. 369. Every competent locator has the right to initiate a lawful claim to unappropriated public land by a peaceable adverse entry upon it while it is in the possession of those who have no superior right to acquire the title or to hold the possession. Any other rule would make the wrongful occupation of public land by a trespasser superior in right to a lawful entry of it under the acts of congress by a competent locator. Thallman vs Thomas, supra (s21); Malone vs. Jackson, supra (s221); see, also, Nevada Sierra Co. vs. Home Oil Co., supra (s221); Miller vs Chrisman, supra (s31)
s10 Imperial Co. vs. Webb, 190 Ky. 41, 225 S. W. 1076.
s11 Cosmos Co. vs. Grey Eagle Co., supra, (s41) 112 Fed. 4, 190 U. S. 301; McLemore vs. Express Co., supra, (s51)
s18 Hayes vs. Lavagnino, 17 Utah 196, 53 Pac. 1029. By the term "veins or lodes" as used in the mining statutes is meant lines or aggregations of minerals embedded in quartz or other rock in place. U. S. vs. Ohio Oil Co., 240 Fed. 1000.
s10 Haack vs. San Fernando Co., 177 Cal. 140, 169 Pac. 1021.
s20 Bennett vs. Twin Falls Co., 27 Ida. 643, 150 Pac. 339.

which are required to prevent lasting damage to the freehold or The term is not an arbitrary one, however, to be applied inflexibly, without regard to the quality of the estate or the relation to it of the person charged to have committed the wrong, but the question as to whether it has been committed in a given case is to be determined in view of the particular facts and circumstances appearing in that case.321

CCI. Who Are and Who Are Not Co-owners.

Tenants in common are "co-owners" of the substance of the estate. They may make such reasonable use of the common property as is necessary to enjoy the benefit and value of such ownership. Since an estate cf a "co-owner" in a mine or oil well can only be enjoyed by removing the product thereof, the taking of mineral from a mine and the extraction of oil from an oil well are the use and not the destruction of the estate.321a

A person having merely an inchoate title, such as the holder of a sheriff's certificate of purchase, is not a "co-owner." A stockholder who has no title separate and distinct from that of the corporation which is the owner of a mining claim is in no sense a "co-owner" with the corporation nor with the other shareholders of such corporation. 323

CCII. Withdrawals.

1. "Withdrawals" are a law made, a joint resolution passed by Congress, a proclamation made by the President, or an order issued by

officers of the Land Department, or other proper officer.

Thereby public lands are withdrawn from location, sale and entry under the laws affecting the public domain. They sometimes are made in recognition of what is about to occur and sometimes in recognition of what has occurred.³²⁴ A withdrawal by proclamation of the President takes effect from its date. An executive withdrawal operates from the time it is made or when received at the local land-office, as its terms may dictate. 325

2. Mineral Rights. Under the Withdrawal Act of June 25, 1910, 326 a homestead entry on withdrawn lands secures no right to the oil below the surface, nor the right to prospect therefor. These rights are

reserved to the United States.327

3. Restored Lands. Under the provisions of the act of September 30, 1913, public lands which have been excluded from national forests

^{**21**}Chapman vs. Cooney, 25 R. I. 657, 57 Atl. 929. As was said in McCord vs. Oakland Co., 64 Cal. 140, 127 Pac. 863: "The law on this subject must be applied with reasonable regard to the circumstances."

21aPrairie**Co. vs. Allen, 2 Fed. (2d) 566 and cases cited. But see Zeigler vs. Brenneman, 230 Ill. 15, 86 N. E. 597; Gulf Ref. Co. vs. Carroll, 145 La. 299, 82 So. 597; South Penn Co. vs. Haught, 71 W. Va. 720, 78 S. E. 759.

22Repeater Claims, 35 L. D. 56; see Turner vs. Sawyer, 150 U. S. 578.

22Repeater Claims, **supra** (**22**); Yard, 38 L. D. 68.

24See 5 U. S. Comp. St., pp. 2320, 2321, 2322. §* 4523, 4524, 4526; U. S. vs. Midwest Co., 236 U. S. 459, rev'g, 206 Fed. 141; U. S. vs. Ohio Co., **supra** (**3**); U. S. vs. Stockton Oil Co., 240 Fed. 1006; U. S. vs. North American Co., 242 Fed. 723; U. S. vs. Thirty-Two Oil Co., 242 Fed. 730; U. S. vs. Record Oil Co., **supra** (**5**); U. S. vs. Caribou Oil Co., 242 Fed. 746; Con. Mutual Oil Co. vs. U. S., **supra** (**6**); For a collation of cases see, 48 L. D. 97; see, also, Id. 172; and see Wood vs. Beach, 156 U. S. 648; U. S. vs. Hodges, 218 Fed. 87; Knudsen vs. Omanson, 10 Utah 124, 37 Pac. 256); see, also, U. S. vs. McCutchen, 217 Fed. 650; Johnson, (on rehearing) 48 L. D. 18.

2 Smith, 33 L. D. 677; N. P. R. Co. vs. Pettit, 14 L. D. 591; U. P. R. Co. vs. Peterson. 28 L. D. 32.

Under the Act of June 30, 1919, no lands may now be withdrawn or Indian Reservation established except by Act of Congress, 2 Supp., U. S. Comp. St., p. 1358, § 4529b.

2 Son vs. Adamson, 188 Cal. 99; 204 Pac. 392.

or released from withdrawals may be disposed of by such methods as the President may provide. 328

CCIII. Working a Claim.

To "work" a mining claim is to do something toward making it productive, such as developing or extracting an ore body after it is discovered.329

CCIV. Workmen's Compensation Acts.

The object of workmen's compensation laws is to substitute for the imperfect and economic wasteful common-law system by private action by an injured employee for damages for negligence on the part of the employer, a system by which every employee in a hazardous industry might receive compensation for any injury suffered by him arising out of and in the course of the employment. Under the common-law action the injured employee could only recover by proof of negligence on the part of the employer and by proof of freedom from contributory negligence on his own part. Under workmen's compensation laws it is not necessary to prove either negligence on the part of the employer nor freedom from negligence on the part of an injured employee. The theory of such legislation is the loss occasioned by reason of injury to employees shall not be borne by the employees alone, as under the common-law system, but directly by the injury itself and indirectly by This class of legislation has been formulated after the the public. most patient study and investigation by the most eminent men in professional and industrial walks of life in order to avoid any obstructions or limitations as might be encountered under the written constitution, as such laws now in force in a great number of the states have in almost every instance been held constitutional.³³⁰

CCV. Zone.

A metal zone is equivalent to a mineral zone yet the terms "mineral" and "metal" are not synonymous. 331

^{328 5} U. S. Comp. St., p. 5322, § 4528. For opening of lands restored by the Secretary of the Interior after withdrawal, see Id. § 4529, 40 L. D. 656; Donley vs. West, 31 Cal. A. 937; 189 Pac. 1052.
329 Cole vs. Ralph, supra (7); see Bailey vs. Bond, 77 Fed. 406; Mt. Diablo Co. vs. Callison, 17 Fed. Cas. 9886.
330 Shea vs. North-Butte Co., 55 Mont. 522, 179 Pac. 501; see Arizona Copper Co. vs. Hammer, 250 U. S. 400; Cudahy P. Co. vs. Parramore, 263 U. S. 418.
For a case involving scope of employment and the right to compensation, see Atolia Co. vs. Industrial Accident Com., supra. (329)
331 Mt. Diablo Co. vs. Callison, supra (329); see N.º P. R. Co. vs. Soderberg, 99 Fed. 9886. A belt or zone, in order to constitute a lode, must bear some of the minerals or valuable deposits mentioned in the statute. Meydenbauer vs. Stevens, supra. (329) "Kidneys" is a term applied by miners to a mineral zone which narrows down until very thin and then suddenly expands and again suddenly contracts. Meydenbauer vs. Stevens, 78 Fed, 791; Rough Rider, supra. (277)

ADMINISTRATIVE DIVISION.

WALTER W. BRADLEY, Deputy State Mineralogist.

Personnel.

During the period, October 15-January 15, the following changes in

personnel have taken place:

Mr. Forest L. Campbell has returned to the post of Librarian of the Bureau, after an absence of several months as an inspector in the oil division.

New Publications.

During the quarterly period covered by this issue, the following Bureau publications have been made available for distribution:

Bulletin No. 94, "California Mineral Production for 1923," by Walter W. Bradley.

Bulletin No. 94, "California Mineral Production for 1923," by Walter W. Bradley. For free distribution.

Mining in California (quarterly), October, 1924, being Chapter No. 4 of State Mineralogist's Report XX. Price 25 cents (or \$1.00 for the year).

Summary of Operations—California Oil Fields, Vol. 10, Nos. 1, 2 and 3, July, August and September, 1924, respectively.

Commercial Mineral Notes: Nos. 19, 20, 21, October-December (inclusive). These "notes" carry the lists of "mineral deposits wanted" and "minerals for sale," issued in the form of a mimeographed sheet, monthly. It is mailed free of charge to those on the mailing list for "Mining in California."

Mails and Files.

The Bureau maintains, in addition to its correspondence file, a mine report file which includes reports on some 7500 mines and mineral properties in California. Also there is available to the public a file of the permits granted to mining and oil corporations by the State Commissioner of Corporations.

During the period covered by this quarterly report, there were 1771 letters received and answered at the San Francisco office alone, covering almost every conceivable phase of prospecting, mining and developing mineral deposits, reduction problems, and marketing of refined

products.

DIVISION OF MINERALS AND STATISTICS.

Statistics, Museum, Laboratory.

WALTER W. BRADLEY, Deputy State Mineralogist.

STATISTICS.

Estimate of 1924 Output.

California Mineral Production in 1924, a New High Record.

The total value of the mineral production of California for the year 1924, just closed, is conservatively estimated to have been approximately \$358,745,000. This is, in part, detailed in the tabulation below; but, as there are fifty mineral substances on California's commercial list, it is impracticable at this early date to obtain anything approaching definite figures on other than the more important items. The blank report forms are being mailed out to the operators in all mineral lines, and the date of publication of the final and complete report will depend

upon the promptness of their replies.

This estimated total of \$358,745,000 is an increase of nearly \$15,000,000 over the 1923 production, which in turn surpassed the previous record value of the year 1921. This increase in value is due in part to petroleum which, although decreasing some 33,000,000 barrels in quantity, it is estimated will show an advance in total value for the year because of the higher prices per barrel prevailing during 1924. The greatest declines in quantity were in the Santa Fe Springs, Huntington Beach and Long Beach fields, following the flush period; but this was partly offset by the development of new fields and the resumption of closed-in production in some of the older fields.

Though reports from a number of the gold mining districts have been indicative of renewed interest and renewing operations, receipts of bullion at the mint and smelters show a decrease for the year, due to lessened output from the dredges. Smelter reports give increased quantities for copper but less lead and silver. Zinc again appears after

an absence in 1923.

As the demand for building materials continued active during 1924, nearly all items of the structural group will show increased quantities and total values, especially cement, brick, hollow building tile, crushed rock, sand and gravel. Magnesite shipments decreased about 15 per cent in quantity, and the market price dropped off somewhat, owing to increased imports from India. The demand for this material for stucco and other plastic purposes is showing a healthy growth. There were no notable changes in the general status of the miscellaneous 'industrial' group, nor among the salines. Demand for achitectural terra cotta and tile has caused increased shipments of pottery clays of all grades. Preliminary reports indicate that most of the salines group will show increases for 1924.

The estimated quantities and values for 1924 are tabulated as follows:

\$12,975,000 gold.

2,225,000 (3,338,000 fine oz.) silver.

6,879,000 (53,330,000 lb.) copper.

413,000 (5,162,000 lb.) lead. 149,000 (2,380,000 lb.) zinc.

30,000 iron and manganese ores. 550,000 (8,100 flasks) quicksilver.

50,000 (6,100 hasks) quickshive 50,000 (400 fine oz.) platinum.

250,000,000 (230,000,000 bbl.) petroleum.

16,250,000 (250,000,000 M. cu. ft.) natural gas.

28,320,000 (11,800,000 bbl.) cement.

17,000,000 crushed rock, sand and gravel. 10,200,000 brick and hollow building tile.

704,000 (64,000 tons) magnesite.

2,000,000 other structural materials, including granite, lime, marble, et al.

6,000,000 miscellaneous 'industrial' minerals (including asbestos, barytes, pottery clays, dolomite, feldspar, gems, graphite, diatomaceous earth, limestone, lithia, mineral water, shale oil, silica, tale, et al.).

5,000,000 salines (including borates, calcium and magnesium chlorides, potash, salt, soda).

\$358,745,000 Total value.

MUSEUM.

The Museum of the State Mining Bureau possesses an exceptionally fine collection of rocks and minerals of both economic and academic value. It ranks among the first five of such collections in North America; and contains not only specimens of most of the known minerals found in California, but much valuable and interesting material from other states and foreign countries as well.

Mineral specimens suitable for exhibit purposes are solicited, and their donation will be appreciated by the State Mining Bureau as well

as by those who utilize the facilities of the collection.

The exhibit is daily visited by engineers, students, business men, and prospectors, as well as tourists and mere sightseers. Besides its practical use in the economic development of California's mineral resources, the collection is a most valuable educational asset to the state and to San Francisco.

LABORATORY.

FRANK L. SANBORN, Mineral Technologist.

There is still an active demand for good radio crystal detectors, and undoubtedly there are many deposits of galena or other minerals in this state that could be utilized for this purpose. The most popular minerals used as crystal rectifiers are galena and pyrite. Other minerals are used, however, among them being zincite, bornite, chalcopyrite, molybdenite, octahedrite, brookite and argentite.

The best crystal detectors so far received at the laboratory of the State Mining Bureau came from Inyo County, and as but few samples of possible detectors have been received since facilities for testing them

have been installed in this laboratory, it is possible that future testing of crystals will prove the existence of other good deposits of mineral suitable for this work.

Evidently much interest is being taken throughout the state in the prospecting for minerals in general, for the number of samples now received at the bureau each month is greater than at any time since the bureau was organized over forty years ago. During the past four months 1535 samples were received and determined.

Samples of clay have recently been the most frequent mineral

received for identification.

California has extensive and varied clay deposits, but published information regarding the California clays is meager. There are many different kinds of clays in this state and uses will probably be found for many of these silicates. In addition to the ceramic industries, clays are used for many purposes, but ordinarily chemical analysis is of little value in determining the best use to which a clay is suited.

Fuller's earth is a variety of clay which has the power of absorbing greasy substances. It is difficult to distinguish this material from ordinary clay. A quantitative analysis shows that it possesses a higher percentage of combined water than ordinary clay. A physical test is

the best method of identifying fuller's earth.

LIBRARY.

FOREST L. CAMPBELL, Librarian.

In addition to the numerous standard works, authoritative information on many phases of the mining and mineral industry is constantly being issued in the form of reports and bulletins by various government agencies.

The library of the State Mining Bureau contains some five thousand selected volumes on mines, mining and allied subjects, and it is also a repository for reports and bulletins of the technical departments of federal and state governments and of educational institutions, both domestic and foreign.

It is not the dearth of the latter publications, but rather a lack of knowledge of just what has been published and where the reports may be consulted or obtained, that embarrasses the ordinary person seeking specific information.

To assist in making the public acquainted with this valuable source of current technical information, 'Mining in California' contains under this heading a list of all books and official reports and bulletins received, with names of publishers or issuing departments.

Files of all the leading technical journals will be found in the library, and county and state maps, topographical sheets and geological folios. Current copies of local newspapers published in the mining centers of the State are available for reference.

The library and reading room are open to the public during the usual office hours, when the librarian may be freely called upon for all necessary assistance.

OFFICIAL PUBLICATIONS RECEIVED.

Governmental.

U. S. Geological Survey:

Prof. Paper No. 132-H—The Resuscitation of the Term Bryn Mawr Gravel. By F. Bascom.

Prof. Paper No. 132-G—Discovery of a Balkan Fresh-Water Fauna in the Idaho Formation of Snake River Valley, Idaho. By W. H. Dall.

Prof. Paper No. 132-F—Relations of the Wasatch and Green River Formations in Northwestern Colorado and Southern Wyoming. By J. D. Sears.

Prof. Paper No. 134—Upper Cretaceous and Tertiary Formations of the Western Part of the San Juan Basin, Colorado and New Mexico. By J. B. Reeside.

Prof. Paper No. 135—The Composition of the River and Lake Waters of the United States. By F. W. Clarke.

Bulletin No. 756—Oil and Gas Fields of Lost Soldier-Ferries District, Wyoming.

Bulletin No. 751-C—Geology and Possible Oil and Gas Resources South of Bear Paw Mountains, Montana.

Bulletin No. 750-E—Deposits of Magnesia Alum near Fallon, Nevada. By D. F. Hewitt.

Bulletin No. 750-F—Molybdenite in the Rocky Bar District, Idaho. By F. C. Schrader.

Bulletin No. 751-D—Geologic Structure of San Juan Canon and Adjacent
 Country, Utah. By H. P. Miser.
 Bulletin No. 762—Geology and Ore Deposits of the Rochester District,

Nevada. By A. Knopf.

Bulletin No. 751-E—The Scobey Lignite Field Valley, Daniels and Sheridan Counties, Montana. By A. J. Collier.

Bulletin No. 751-G—Geology and Oil and Gas Prospects of Part of Moffat County, Colorado, and Southern Sweetwater County, Wyoming. By J. D. Sears.

LIBRARY. 127

Bulletin No. 753—Geology and Oil Resources of a Part of Los Angeles and Ventura Counties, California, By Wm. S. W. Kew.

Bulletin No. 765—Geology of the Region Around Lead, South Dakota. By Sidney Paige.

Water Supply Paper No. 521—Part I. North Atlantic Slope Drainage Basins.

Water Supply Paper No. 517. Great Salt Lake Basin.

Water Supply Paper No. 514. Surface Water Supply of the United States. Part XII—North Pacific Slope Drainage Basins.

Water Supply Paper No. 525. Hudson Bay and Upper Mississippi River Basins. By N. C. Grover.

Water Supply Paper No. 520-D. Base Exchange in Ground Water by Silicates as Illustrated in Montana. By B. C. Renick.

Water Supply Paper No. 532. Part XII—North Pacific Slope Drainage Basins. A—Pacific Basins in Washington and Upper Columbia River Basins.

Water Supply Paper No. 513-B. Snake River Basin.

Mineral Resources of the United States:

Copper in 1923. Lime in 1923.

Feldspar in 1923.

Phosphate Rock in 1923.

Tale and Soapstone in 1923.

Lead in 1923.

Magnanese and Manganiferous Ores in 1923.

Mineral Waters in 1923.

Lead and Zinc Pigments and Salts in 1923.

Arsenic in 1923.

Sand and Gravel in 1923.

Salt, Bromine and Calcium Chloride in 1923.

Asphalt and Related Bitumens in 1923.

Chromite in 1923.

Rare Metals in 1923.

Silica in 1923.

Potash in 1923.

Silver, Copper, Lead and Zinc in the Central States in 1923.

Quicksilver in 1923.

Tin in 1923.

Fuel Briquetts in 1923.

Slate in 1923.

Gypsum in 1923.

Carbon Black from Natural Gas in 1923.

Peat in 1923.

Secondary Metals in 1923.

Stone in 1923.

Coal in 1922.

Zinc, Copper, Lead and Silver in 1923.

Bismuth, Selenium and Tellurium in 1923.

Graphite in 1923.

Fullers Earth in 1923.

Barytes and Barium in 1923.

Zinc in 1923.

Clay in 1923.

Fifty-first Annual Report of the Director, to the Secretary of the Interior for the Fiscal Year ended June 30, 1924.

U. S. Bureau of Mines:

Bulletin No. 228—Estimation of Underground Oil Reserves by Oil Well Production Curves. By W. W. Cutler.

Bulletin No. 227-Flame Safety Lamps.

Bulletin No. 241—Coal Mine Fatalities in the United States, 1923.

Reports of Investigations:

Serial No. 2634—Magnetic Recovery of Combustible in Boiler Plant Refuse.

By Rudolf Kudlich.

Serial No. 2635—Explosives used in July, 1924. By W. W. Adams.

Serial No. 2636-Tenth Semi-Annual Motor Gasoline Survey. By N. F. Lejune and B. A. Landry.

Serial No. 2637-Some Features of Ventilating Fans at 164 Coal and Metal Mines. By D. Harrington and M. W. von Bernewitz.

Serial No. 2638-The Critical Time of Day for Coal Mine Explosions. By L. D. Tracy and M. W. von Bernewitz.

Serial No. 2639—Improvement of the Geophone by the use of Electrical Sound Amplifiers. By Walter T. Ackley, Jr., and Clifton M. Ralph.

Serial No. 2640—(Withdrawn.)

Serial No. 2641—Mine Accident Statistics. By W. W. Adams.

Serial No. 2642—Coal Mine Fatalities in August, 1924. By W. W. Adams (Statistician, Bureau of Mines.)

Serial No. 2643—Explosives used in August, 1924. By W. W. Adams.

Serial No. 2644-Additions, Removals and Changes in Permissible List of Explosives from January 1, 1924, to September 30, 1924. By J. E. Crawshaw.

Serial No. 2645—Revised List of Publications on Ceramic Investigations, Bureau of Mines. By L. E. Geyer.

Serial No 2646—Special Sands. By W. M. Weigel. Serial No. 2647—The Resistance of Coal Mine Entries to the Flow of Air. By J. W. Paul, H. P. Greenwald and G. E. McElroy.

Serial No. 2648—Calcined Dolomite as a Substitute for Lime in the Recovery of Gold and Silver by the Cyanide Process. By E. S. Leaver, C. W. Davis and J. A. Woolf.

Serial No. 2649—Explosion Hazards Incidental to Unwatering Coal Mines. By L. D. Tracy.

Serial No. 2650—Coal Mine Fatalities in September, 1924. By W. W. Adams. Serial No. 2651—Factors Retarding Transmission of Radio Signals Underground, and Some Further Experiments and Conclusions. By J. J. Jakosky and D. H. Zellers.

Serial No. 2652—Zinc Used for Roofing. By Chas. E. van Barneveld.

Serial No. 2653—Explosives Used in September, 1924. By W. W. Adams. Serial No. 2654—Effects of Temperature and Pressure on Gypsum and Anhydrite. By Marie Farnsworth.

Serial No. 2655—The Analysis of Oil Wax Mixtures. By L. D. Wyant and L. G. Marsh.

Serial No. 2656—The Production of Sponge Iron. By Clyde E. Williams, Edward P. Barrett, and Bernard M. Larsen.

Serial No. 2657—Coal Mine Fatalities in October, 1924. By W. W. Adams. Miners Circular No. 28-Sanitation in Mines. By R. R. Sayers.

Technical Paper No. 336—Oxidation of Zinc Vapor by Carbon Dioxide. By

B. M. O'Harra. Annual Report of the Director to the Secretary of the Interior for the Fiscal Year ended June 30, 1924.

Queensland, Royal Society of: Proceedings for 1923, Vol. XXXV.

Victoria, Geological Survey of:

Maps: Jumbuk.

Mardan.

Bulga

Koorooman

Callignee.

Western Australia Geological Survey:

Bulletin No. 89—The Geology and Mineral Industry of Western Australia. By A. G. Maitland.

New Zealand, Geological Survey of:

Bulletin No. 26—The Geology and Mines of the Waihi District, Hauaki Goldfield, New Zealand. By P. G. Morgan.

New South Wales, Department of Mines: Annual Report, 1923.

Scotland, Geological Survey of:

Memoirs. Tertiary and Post-Tertiary Geology of Mull.

Economic Geology of Central Coalfield of Scotland.

England, Ordinance Survey of:

Maps:

Hertford.

Wem (Drift).

Wem (Solid).

Great Britain, Geological Survey of:

The Geology of the Country Around Dartford. By Henry Dewey. The Geology of the Country Around Hertford. By R. L. Sherlock.

Summary of Progress for 1923.

Geology of Flint, Hawarden, Etc., 1924. Geology of Brighton and Worthing, 1924.

Special Mineral Reports, 1924.

Warsaw, Polish Ministry of Foreign Offairs:

Production of Coal, Lignite, Coke and Coal Briquettes for the Month of June, 1924.

Production of Petroleum, Natural Gas and Mineral Wax for the Months of May and June, 1924.

Production of Salt and Potassium Salts for the Month of June, 1924.

U. S. Army:

Annual Report of the Chief of Engineers for 1924.

Federal Power Commission:

Four Annual Report, 1924.

Smithsonian Institution:

Proceedings of the U.S. National Museum, Vol 63.

U. S. Treasury Department:

Annual (1924) Report of the Director of the Mint.

U. S. Coast and Geodetic Survey:

Earth Movements in California. By William Bowie. Geodetic Operations, January 1, 1922—December 31, 1923.

Annual Report of the Director to the Secretary of Commerce for the Fiscal Year ended June 30, 1924.

Librarian of Congress:

Report for the Fiscal Year Ended June 30, 1924.

Alabama, Geological Survey of:

Bulletin No. 27—Statistics of the Mineral Production of Alabama for 1922. By W. S. Ernst.

Museum Paper No. 7-The Genus Gyrotoma. By C. Goodrich.

Illinois, State Geological Survey:

Prospects for Oil in Decatur Area, Illinois.

Kentucky Geological Survey:

The Road Materials of Kentucky. By C. H. Richardson.

A Bibliography of the Several Books, Reports and Maps Principally Relating to Geology.

Kentucky State Parks, 1924.

North Carolina Geological and Economic Survey:

Some Facts and Figures About North Carolina and Her Natural Resources.

Pennsylvania Geological Survey:

Bituminous Coal Losses and Mining Methods in Pennsylvania. By J. D. Sisler.

Bulletin No. M3-Lead and Zinc Ores of Pennsylvania. By B. L. Miller.

Bulletin No. M5—The Silicia Refractories of Pennsylvania. By E. S. Moore. Washington, Department of Conservation and Development:

Bulletin No. 30—Mineral Resources of Washington with Statistics for 1922.

Bulletin No. 29-Coal Fields of Skagit County, Washington.

Canada, Department of Mines:

Bentonite. By H. S. Spence.

Development of Chemical Metallurgical and Allied Industries in Canada in Relation to the Mineral Industry. By A. W. Wilson,

Thirty-second Annual Report of the Ontario Department of Mines.

The Mining Laws of Canada.

Bulletin No. 625—Bituminous Sands of Northern Alberta. By Sidney C. Ellis. Canadian Arctic Expedition, 1913-1918.

Memoir 139-Coginhalla Area, British Columbia.

Report on Ontario Iron Ores, 1923.

Thirty-first Annual Report and Maps, Ontario Department of Mines, Vol. 31, Part II, 1922.

Canada, The Dominion Fuel Board:

Central and District Heating Possibilities of Application in Canada. By F. A. Combe.

Transvaal Chamber of Mines:

Thirty-fourth Report, 1923.

Montevideo, Instituto de Geologia y Perferaciones:

Boletin No. 6, June, 1924.

Archivos do Museu Nacional do Rio de Janiero. Vol XXIV.

Boletin do Museu Nacional do Rio de Janiero. March, 1924.

Deputy Master and Comptroller of the Royal Mint:

Fifty-fourth Annual Report, 1923.

Queensland Geological Survey:

Publication No. 273—Mesozoic Insects of Queensland. By R. J. Tillyard.

Societies and Educational Institutions.

University of California:

Pelecypoda from the Marine Oligocene of Western North America. By B. L. Clark.

Pennsylvania State College:

Bulletin No. 32—Heat Transmission and Efficiency in Steam Boiler Tubes. By E. A. Fessenden.

Bulletin No. 31—A New Application of the Induction Motor in Signalling Devices. By P. X. Rice.

American Institute of Mining and Metallurgical Engineers:

Transactions, Vol. LXX.

Boletin del Cuerpo de Ingenieros de Minas del Peru. No. 107.

The Mineral Industry, 1923, Vol. 32.

The Mines Handbook, 1925.

Maps.

U. S. Geological Survey Topographic Sheets:

Alto Pass, Ill.-Mo.

Barre, Vt. Braymer, Mo.

Dinuba, Calif. Frankfort, Ky.

Kankakee, Ill.

Lebanon, Oregon. Momence, Ill.-Ind.

Oregon, Ill.

Spruce Knob, W. Va.-Va.

Tranquillity, Cal.

Current Magazines on File.

For the convenience of persons wishing to consult the technical magazines in the reading room, a list of those on file is appended:

American Petroleum Institute, New York.

Architect and Engineer, San Francisco.

Arizona Mining Journal, Phoenix, Arizona.

Asbestos, Philadelphia, Pennsylvania.

Brick and Clay Record, Chicago.

Bulletin, Union Oil Co., Los Angeles.

California Journal of Development, San Francisco.

Cement, Mill and Quarry, Chicago, Illinois.

Chemical Engineering and Mining Review, London, England.

Engineering and Mining Journal-Press, New York.

Explosives Engineer, Wilmington, Del. Financial Insurance News, Los Angeles, California.

Graphite, Jersey City.

Journal of Electricity and Western Industry, San Francisco.

Metallurgical and Chemical Engineering, New York.

Mine and Quarry, Chicago.

Mining and Engineering Record, Vancouver, B. C.

Mining and Oil Bulletin, Los Angeles.

Oil Age, Los Angeles.

Oil and Gas Journal, Tulsa, Oklahoma.

Oil and Gas News, Kansas City.

Oil News, Galesburg, Illinois.

Oildom, New York.

Oil, Paint and Drug Reporter, New York.

Oil Trade Journal, New York.

Oil Weekly, Houston, Texas.

Petroleum Age, New York.

Petroleum Record, Los Angeles.

Petroleum World, Los Angeles.

Queensland Government Mining Journal, Brisbane, Australia.

Rock Products, Chicago, Illinois.

Safety News, Industrial Accident Commission, San Francisco.

Salt Lake Mining Review, Salt Lake City, Utah.

Southwest Builder and Contractor, Los Angeles.

Standard Oil Bulletin, San Francisco.

Stone, New York.

The Record, Associated Oil Company, San Francisco.

Through the Ages, Baltimore.

Newspapers.

The following papers are received and kept on file in the library:

Amador Dispatch, Jackson, Cal.

Arkansas Oil and Mineral News, Hot Springs National Park (Arkansas).

Barstow Printer, Barstow, Cal.

Blythe Herald, Blythe, Cal. Bridgeport Chronicle-Union, Bridgeport, Mono Co., Cal.

Calaveras Prospect, San Andreas, Cal.

California Oil World, Los Angeles, Cal.

Cloverdale Reveille, Cloverdale, Cal.

Colusa Daily Sun, Colusa, Cal. Daily Commercial News, San Francisco, Cal.

Daily Midway Driller, Taft, Cal.

Del Norte Triplicate, Crescent City, Cal.

Exeter Sun, Exeter, Cal.

Gateway Gazette, Beaumont, Cal.

Goldfield News, Goldfield, Nevada.

Guerneville Times, Guerneville, Cal.

Healdsburg Enterprise, Healdsburg, Cal.

Humboldt Standard, Eureka, Cal.

Inyo Independent, Independence, Cal.

Inyo Register, Bishop, Cal.

Ione Valley Echo, Ione, Cal.

Lake County Bee, Lakeport, Cal.

Mining and Financial Record, Denver, Colo.

Mining Topics, Sacramento, Cal., and Unionville, Nev.

Mountain Democrat, Placerville, Cal.

Mountain Messenger, Downieville, Cal.

Nevada Mining Press, Reno, Nevada.

Oatman Mining News, Oatman, Arizona.

Oregon Observer, Grants Pass, Oregon.

Oroville Daily Register, Oroville, Cal.

Petroleum Reporter, Taft, Cal.

Placer Herald, Auburn, Cal.

Plumas Independent, Quincy, Cal.

Plumas National Bulletin, Quincy, Cal.

Randsburg Times, Randsburg, Cal. San Diego News, San Diego, Cal.

Shasta Courier, Redding, Cal. Siskiyou News, Yreka, Cal. Stockton Record, Stockton, Cal.

Tuolumne Prospector, Tuolumne, Cal. Ventura Daily Post, Ventura, Cal.

Weekly Trinity Journal, Weaverville, Cal.

Western Sentinel, Etna Mills, Cal.

PRODUCERS AND CONSUMERS.

The producer and consumer of mineral products are mutually dependent upon each other for their prosperity, and one of the most direct aids rendered by the Bureau to the mining industry in the past has been that of bringing producers and consumers into direct touch with each other.

This work has been carried on largely by correspondence, supplemented by personal consultation. Lists of buyers of all the commercial minerals produced in California have been made available to producers upon request, and likewise the owners of undeveloped deposits of various minerals, and producers of them, have been made known to those looking for raw mineral products.

When the publication of MINING IN CALIFORNIA was on a monthly basis, current inquiries from buyers and sellers were summarized and lists of mineral products or deposits 'wanted' or 'for sale' included in

each issue.

It is important that inquiries of this nature reach the mining public as soon as possible and in order to avoid the delay incident to the present quarterly publication of MINING IN CALIFORNIA, these lists are now issued monthly in the form of a mimeographed sheet under the title of 'Commercial Mineral Notes.'

EMPLOYMENT SERVICE.

Following the establishment of the Mining Division branch offices in 1919, a free technical employment service was offered as a mutual aid to mine operators and technical men for the general benefit of the mineral industry.

Briefly summarized, men desiring positions are registered, the cards containing an outline of the applicant's qualifications, position wanted, salary desired, etc., and as notices of 'positions open' are received, the names and addresses of all applicants deemed qualified are sent to the prospective employer for direct negotiations.

Telephone and telegraphic communications are also given immediate

attention.

The Bureau registers technical men, or those qualified for supervisory positions, and vacancies of like nature, only, as no attempt will be made

to supply common mine and mill labor.

A list of current applications for positions and 'positions open' is carried in each issue. Notices are designated by a key number, and the name and address corresponding to any number will be supplied upon request, without delay or charge of any kind. If desired, recommendations may be filed with an application, but copies only should be sent to the Bureau, to avoid possible loss. Registration cards for the use of both prospective employers and employees may be obtained at any office of the Bureau upon request, and a cordial invitation is extended to the industry to make free use of the facilities afforded.

POSITIONS WANTED.

31-1 Anything connected with mining.

31-2 Assessment work to do on contract. Thorough placer and quartz mining man. 31-3 Assayer and chemist. Nine years' experience, cement, copper, and commer-

- cial laboratory. Age 29. Single. Reference.

31-4 Mill man or general superintendent. Thirty years' general experience in operation of mines and mills. Age 55. Married. References. Minimum salary, \$200.

31-5 Mining engineer. Over ten years' general experience in operation and examination of mines in the United States, Mexico and South America. Can do surveying and assaying. Age 43. References. Salary open; reasonable.



PUBLICATIONS OF THE CALIFORNIA STATE MINING BUREAU.

During the past forty-four years, in carrying out the provisions of the organic act creating the California State Mining Bureau, there have been published many reports, bulletins and maps which go to make up a library of detailed information on the mineral industry of the state, a large part of which could not be duplicated from any other source.

One feature that has added to the popularity of the publications is that many of them have been distributed without cost to the public, and even the more elaborate ones have been sold at a price which barely covers the cost of printing.

Owing to the fact that funds for the advancing of the work of this department have often been limited, many of the reports and bulletins mentioned were printed in limited editions which are now entirely

exhausted.

Copies of such publications are available, however, in the Bureau's offices in the Ferry Building, San Francisco; Pacific Finance Building, Los Angeles; in Sacramento; Santa Maria; Santa Paula; Coalinga; Taft; Bakersfield. They may also be found in many public, private and technical libraries in California and other states, and foreign countries.

A catalog of all publications of the Bureau, from 1880 to 1917,

giving a synopsis of their contents, is issued as Bulletin No. 77.

Publications in stock may be obtained by addressing any of the offices of the State Mining Bureau and enclosing the requisite amount in the case of publications that have a list price. The Bureau is authorized to receive only coin, stamps or money orders, and it will be appreciated if remittance is made in this manner rather than by personal check.

The prices noted include delivery charges to all parts of the United States. Money orders should be made payable to the State Mining

Bureau.

REPORTS.

REPORTS.	
Asterisks (**) indicate the publication is out of print.	Price
**First Annual Report of the State Mineralogist, 1880, 43 pp. Henry G.	11100
**Second Annual Report of the State Mineralogist, 1882, 514 pp., 4 illustra-	
**Third Annual Report of the State Mineralogist, 1883, 111 pp., 21 illustra-	
**Fourth Annual Report of the State Mineralogist, 1884, 410 pp., 7 illustra-	
tions. Henry G. Hanks**Fifth Annual Report of the State Mineralogist, 1885, 234 pp., 15 illustra-	
tions, 1 geological map. Henry G. Hanks**Sixth Annual Report of the State Mineralogist, Part I, 1886, 145 pp., 3	
illustrations, 1 map. By Henry G. Hanks	
Part II, 1887, 222 pp., 36 illustrations. William Irelan, JrSeventh Annual Report of the State Mineralogist, 1887, 315 pp. William	
Irelan, Jr**Eighth Annual Report of the State Mineralogist, 1888, 948 pp., 122 illustra-	
tions. William Irelan, Jr**Ninth Annual Report of the State Mineralogist, 1889, 352 pp., 57 illustra-	
tions, 2 maps. William Irelan, Jr.	

REPORTS-Continued.

Asterisks (**) indicate the publication is out of print.	Theles
**Tenth Annual Report of the State Mineralogist, 1890, 983 pp., 179 illustra-	Price
tions, 10 maps. William Irelan, Jr. Eleventh Report (First Biennial) of the State Mineralogist, for the two years ending September 15, 1892, 612 pp., 73 illustrations, 4 maps. William Irelan, Jr.	\$1.00
**Twelfth Report (Second Biennial) of the State Mineralogist, for the two years ending September 15, 1894, 541 pp., 101 illustrations, 5 maps.	ψ1.00
J. J. Crawford **Thirteenth Report (Third Biennial) of the State Mineralogist, for the two years ending September 15, 1896, 726 pp., 93 illustrations, 1 map. J. J. Crawford	
Chapters of the State Mineralogist's Report, Biennial Period, 1913-1914, Fletcher Hamilton:	
**Mines and Mineral Resources, Amador, Calaveras and Tuolumne Counties, 172 pp., paper	
Mines and Mineral Resources, Colusa, Glenn, Lake, Marin, Napa, Solano, Sonoma and Yolo Counties, 208 pp., paper	.50
Mines and Mineral Resources, Del Norte, Humboldt, and Mendocino Counties, 59 pp., paper	.25
**Mines and Mineral Resources, Fresno, Kern, Kings, Madera, Mariposa, Merced, San Joaquin and Stanislaus Counties, 220 pages, paperMines and Mineral Resources of Imperial and San Diego Counties,	
**Mines and Mineral Resources, Shasta, Siskiyou and Trinity Counties,	.35
180 pp., paperFourteenth Report of the State Mineralogist, for the Biennial Period 1913-	
1914, Fletcher Hamilton, 1915: A General Report on the Mines and Mineral Resources of Amador, Calaveras, Tuolumne, Colusa, Glenn, Lake, Marin, Napa, Solano, Sonoma, Yolo, Del Norte, Humboldt, Mendocino, Fresno, Kern, Kings, Madera, Mariposa, Merced, San Joaquin, Stanislaus, San Diego, Imperial, Shasta, Siskiyou, and Trinity Counties, 974 pp., 275 illustrations, cloth	2.00
Chapters of the State Mineralogist's Report, Biennial Period, 1915-1916, Fletcher Hamilton:	00
Mines and Mineral Resources, Alpine, Inyo and Mono Counties, 176 pp.,	.65
Same, including geological map of Inyo County Mines and Mineral Resources, Butte, Lassen, Modoc, Sutter, and Tehama	1.25
Counties, 91 pp., paperMines and Mineral Resources, El Dorado, Placer, Sacramento, and Yuba Counties, 198 pp., paper	.65
Mines and Mineral Resources, Monterey, San Benito, San Luis Obispo, Santa Barbara, and Ventura Counties, 183 pp., paper Mines and Mineral Resources, Los Angeles, Orange, and Riverside Counties,	.65
136 pp., paper Mines and Mineral Resources, San Bernardino and Tulare Counties, 186 pp.,	.50
paper	.65
1916, Fletcher Hamilton, 1917: A general Report on the Mines and Mineral Resources of Alpine, Inyo, Mono, Butte, Lassen, Modoc, Sutter, Tehama, Placer, Sacramento, Yuba, Los Angeles, Orange, Riverside, San Benito, San Luis Obispo, Santa Barbara, Ventura, San Bernardino and Tulare Counties, 990 pp., 413 illustrations, cloth	3.75
Chapters of the State Mineralogist's Report, Biennial Period 1917-1918, Fletcher Hamilton:	
Mines and Mineral Resources of Nevada County, 270 pp., paper Mines and Mineral Resources of Plumas County, 188 pp., paper Mines and Mineral Resources of Sierra County, 144 pp., paper Seventeenth Report of the State Mineralogist, 1920, Mining in California	.75 .50 .50
during 1920 Fletcher Hamilton: 562 nn. 71 illustrations, cloth	1.75

REPORTS-Concluded.

REPORTS—Concluded.	
Asterisks (**) indicate the publication is out of print.	
Eighteenth Report of the State Mineralogist, 1922, Mining in California, Fletcher Hamilton. Chapters published monthly beginning with Jan-	Price
uary, 1922:	
**January, **February, March, April, May, June, July, August, September, October, November, December, 1922	Free
Fletcher Hamilton and Lloyd L. Root. January, February, March, September, 1923	Free
Chapters of Twentieth Report of the State Mineralogist, 'Mining in California,' Lloyd L. Root. Published quarterly. January, April, July, October, 1924, per copy	\$0.25
('hapters of Twenty-first Report of State Mineralogist, Mining in California, L. Root. Published quarterly. January, 1925 Subscription, \$1.00 in advance (by calendar year, only).	
Chapters of State Oil and Gas Supervisor's Report: Summary of Operations—California Oil Fields, July, 1918, to March, 1919	
(one volume) Summary of Operations—California Oil Fields. Published monthly, begin-	Free
ning April, 1919:	
**April, **May, June, **July, **August, **September, **October, November, **December, 1919	Free
January, February, March, April, **May, June, July, **August, September,	Free
January, **February, **March, **April, May, June, **July, August, **September, **October, **November, **December, 1921	Free
January, February, March, April, May, June, July, August, September, October, November, December, 1922	Free
January, February, March, April, May, June, July, August, September,	Free
October, November, December, 1923	Free
	Tree
BULLETINS.	Fiec
BULLETINS. Asterisks (**) indicate the publication is out of print. **Bulletin No. 1. A Description of Some Desiccated Human Remains, by	Price
Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrationsBulletin No. 2. Methods of Mine Timbering, by W. H. Storms. 1894,	
**Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrations	
**Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrations. **Bulletin No. 2. Methods of Mine Timbering, by W. H. Storms. 1894, 58 pp., 75 illustrations. **Bulletin No. 3. Gas and Petroleum Yielding Formations of Central Valley of California, by W. L. Watts. 1894, 100 pp., 13 illustrations, 4 maps. **Bulletin No. 4. Catalogue of Californian Fossils, by J. G. Cooper, 1894, 73 pp., 67 illustrations. (Part I was published in the Seventh Annual	Price
**Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrations. **Bulletin No. 2. Methods of Mine Timbering, by W. H. Storms. 1894, 58 pp., 75 illustrations. **Bulletin No. 3. Gas and Petroleum Yielding Formations of Central Valley of California, by W. L. Watts. 1894, 100 pp., 13 illustrations, 4 maps. **Bulletin No. 4. Catalogue of Californian Fossils, by J. G. Cooper, 1894, 73 pp., 67 illustrations. (Part I was published in the Seventh Annual Report of the State Mineralogist, 1887.) **Bulletin No. 5. The Cyanide Process, 1894, by Dr. A. Scheidel. 140 pp.,	Price
**Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrations. **Bulletin No. 2. Methods of Mine Timbering, by W. H. Storms. 1894, 58 pp., 75 illustrations. **Bulletin No. 3. Gas and Petroleum Yielding Formations of Central Valley of California, by W. L. Watts. 1894, 100 pp., 13 illustrations, 4 maps. **Bulletin No. 4. Catalogue of Californian Fossils, by J. G. Cooper, 1894, 73 pp., 67 illustrations. (Part I was published in the Seventh Annual Report of the State Mineralogist, 1887.) **Bulletin No. 5. The Cyanide Process, 1894, by Dr. A. Scheidel. 140 pp., 46 illustrations Bulletin No. 6. California Gold Mill Practices, 1895, by E. B. Preston,	Price
**Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrations. **Bulletin No. 2. Methods of Mine Timbering, by W. H. Storms. 1894, 58 pp., 75 illustrations. **Bulletin No. 3. Gas and Petroleum Yielding Formations of Central Valley of California, by W. L. Watts. 1894, 100 pp., 13 illustrations, 4 maps. **Bulletin No. 4. Catalogue of Californian Fossils, by J. G. Cooper, 1894, 73 pp., 67 illustrations. (Part I was published in the Seventh Annual Report of the State Mineralogist, 1887.) **Bulletin No. 5. The Cyanide Process, 1894, by Dr. A. Scheidel. 140 pp., 46 illustrations Bulletin No. 6. California Gold Mill Practices, 1895, by E. B. Preston, 85 pp., 46 illustrations. **Bulletin No. 7. Mineral Production of California, by Counties for the	Price
**Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrations	Price
**Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrations	Price
**Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrations. **Bulletin No. 2. Methods of Mine Timbering, by W. H. Storms. 1894, 58 pp., 75 illustrations. **Bulletin No. 3. Gas and Petroleum Yielding Formations of Central Valley of California, by W. L. Watts. 1894, 100 pp., 13 illustrations, 4 maps. **Bulletin No. 4. Catalogue of Californian Fossils, by J. G. Cooper, 1894, 73 pp., 67 illustrations. (Part I was published in the Seventh Annual Report of the State Mineralogist, 1887.) **Bulletin No. 5. The Cyanide Process, 1894, by Dr. A. Scheidel. 140 pp., 46 illustrations Bulletin No. 6. California Gold Mill Practices, 1895, by E. B. Preston, 85 pp., 46 illustrations. **Bulletin No. 7. Mineral Production of California, by Counties for the year 1894, by Charles G. Yale. Tabulated sheet. **Bulletin No. 8. Mineral Production of California, by Counties for the year 1895, by Charles G. Yale. Tabulated sheet. **Bulletin No. 9. Mine Drainage, Pumps, etc., by Hans C. Behr. 1896, 210 pp., 206 illustrations. **Bulletin No. 10. A bibliography Relating to the Geology, Palæntology and	Price
**Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrations	Price
**Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrations	Price
**Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrations	Price

BULLETINS—Continued.

Asterisks (**) indicate the publication is out of print.	
**Bulletin No. 14. Mineral Production of California, by Counties for 1898,	Price
**Bulletin No. 15. Map of Oil City Fields, Fresno County, by John H. Means, 1899	
**Bulletin No. 16. The Genesis of Petroleum and Asphaltum in California, by A. S. Cooper, 1899, 39 pp., 29 illustrations	
**Bulletin No. 17. Mineral Production of California, by Counties for 1899, by Charles G. Yale. Tabulated sheet	
**Bulletin No. 18. Mother Lode Region of California, by W. H. Storms.	
**Bulletin No. 19. Oil and Gas Yielding Formations of California, by W. L. Watts. 1900, 236 pp., 60 illustrations, 8 maps	
**Bulletin No. 20. Synopsis of General Report of State Mining Bureau, by W. L. Watts. 1901, 21 pp. This bulletin contains a brief statement of the progress of the mineral industry in California for the four years	
**Bulletin No. 21. Mineral Production of California by Counties, by Charles	
**Bulletin No. 22. Mineral Production of California for Fourteen Years, by Charles G. Yale. 1900. Tabulated sheet	
Bulletin No. 23. The Copper Resources of California, by P. C. DuBois, F. M. Anderson, J. H. Tibbits and G. A. Tweedy. 1902, 282 pp., 69	\$0.50
**Bulletin No. 24. The Saline Deposits of California, by G. E. Bailey. 1902, 216 pp., 99 illustrations, 5 maps	ф0.50
**Bulletin No. 25. Mineral Production of California, by Counties, for 1901, by Charles G. Yale. Tabulated sheet	
**Bulletin No. 26. Mineral Production of California for the past Fifteen Years, by Charles G. Yale. 1902. Tabulated sheet	
**Bulletin No. 27. The Quicksilver Resources of California, by William Forstner. 1903, 273 pp., 144 illustrations, 8 maps	
**Bulletin No. 28. Mineral Production of California, for 1902, by Charles G. Yale. Tabulated sheet	
**Bulletin No. 29. Mineral Production of California for Sixteen Years, by Charles G. Yale. 1903. Tabulated sheet	
**Bulletin No. 30. Bibliography Relating to the Geology, Palæntology, and Mineral Resources of California, by A. W. Vogdes. 1903, 290 pp **Bulletin No. 31. Chemical Analyses of California Petroleum, by H. N.	
Cooper. 1904. Tabulated sheet	
W. Prutzman. 1904, 230 pp., 116 illustrations, 14 maps**Bulletin No. 33. Mineral Production of California, by Counties, for 1903,	
by Charles G. Yale. Tabulated sheet**Bulletin No. 34. Mineral Production of California for Seventeen Years,	
by Charles G. Yale. 1904. Tabulated sheet**Bulletin No. 35. Mines and Minerals of California, by Charles G. Yale.	
1904, 55 pp., 20 county maps. Relief map of California	
Bulletin No. 37. Gems, Jewelers' Materials, and Ornamental Stones of California, by George F. Kuntz. 1905, 168 pp., 54 illustrations.	.25
**Bulletin No. 38. Structural and Industrial Materials of California, by Wm. Forstner, T. C. Hopkins, C. Naramore and L. H. Eddy. 1906,	
412 pp., 150 illustrations, 1 map————————————————————————————————————	
by Charles G. Yale. Tabulated sheet**Bulletin No. 40. Mineral Production of California for Eighteen Years, by Charles G. Yale. 1905. Tabulated sheet	
**Bulletin No. 41. Mines and Minerals of California, for 1904, by Charles G. Yale. 1905, 54 pp., 20 county maps	
**Bulletin No. 42. Mineral Production of California, by Counties, 1905, by Charles G. Yale. Tabulated sheet	

BULLETINS—Continued.

Asterisks (**) indicate the publication is out of print.	
**Bulletin No. 43. Mineral Production of California for Nineteen Years,	Price
by Charles G. Yale. Tabulated sheet.	
**Bulletin No. 44. California Mines and Minerals for 1905, by Charles G.	
Yale. 1907, 31 pp., 20 county maps	
**Bulletin No. 45. Auriferous Black Sands of California, by J. A. Edman. 1907. 10 pp	
Bulletin No. 46. General Index of Publications of the California State	
Mining Bureau, by Charles G. Yale. 1907, 54 pp	\$0.30
**Bulletin No. 47. Mineral Production of California, by Counties, 1906,	
by Charles G. Yale. Tabulated sheet **Bulletin No. 48. Mineral Production of California for Twenty Years.	
1906, by Charles G. Yale	
**Bulletin No. 49. Mines and Minerals of California for 1906, by Charles	
G. Yale. 34 pp	
Bulletin No. 50. The Copper Resources of California, 1908, by A. Haus-	
mann, J. Kruttschnitt, Jr., W. E. Thorne and J. A. Edman, 366 pp., 74 illustrations. (Revised edition.)	1.00
**Bulletin No. 51. Mineral Production of California, by Counties, 1907, by	1.00
D. H. Walker. Tabulated sheet	
**Bulletin No. 52. Mineral Production of California for Twenty-one Years,	
1907, by D. H. Walker. Tabulated sheet	
**Bulletin No. 53. Mineral Production of California for 1907, with County Maps, by D. H. Walker, 62 pp	
**Bulletin No. 54. Mineral Production of California, by Counties, by D. H.	
Walker, 1908. Tabulated sheet	
**Bulletin No. 55. Mineral Production of California for Twenty-two Years,	
by D. H. Walker, 1908. Tabulated sheet**Bulletin No. 56. Mineral Production for 1908, with County Maps and	
**Bulletin No. 56. Mineral Production for 1908, with County Maps and Mining Laws of California, by D. H. Walker. 78 pp	
**Bulletin No. 57. Gold Dredging in California, by W. B. Winston and	
Chas. Janin. 1910, 312 pp., 239 illustrations and 10 maps	
**Bulletin No. 58. Mineral Production of California, by Counties, by D. H.	
Walker, 1909. Tabulated sheet	
**Bulletin No. 59. Mineral Production of California for Twenty-three Years, by D. H. Walker, 1909. Tabulated sheet	
**Bulletin No. 60. Mineral Production for 1909, County Maps and Mining	
Laws of California, by D. H. Walker. 94 pp	
**Bulletin No. 61. Mineral Production of California, by Counties for 1910,	
by D. H. Walker. Tabulated sheet**Bulletin No. 62. Mineral Production of California for Twenty-four Years,	
by D. H. Walker, 1910. Tabulated sheet	
**Bulletin No. 63. Petroleum in Southern California, by P. W. Prutzman.	
1912, 430 pp., 41 illustrations, 6 maps	
**Bulletin No. 64. Mineral Production for 1911, by E. S. Boalich. 49 pp	
**Bulletin No. 65. Mineral Production for 1912, by E. S. Boalich. 64 pp **Bulletin No. 66. Mining Laws of the United States and California. 1914,	
89 pp.	
**Bulletin No. 67. Minerals of California, by Arthur S. Eakle. 1914,	
226 pp.	
**Bulletin No. 68. Mineral Production for 1913, with County Maps and Mining Laws, by E. S. Boalich. 160 pp	
**Bulletin No. 69. Petroleum Industry of California, with Folio of Maps	
(18 by 22), by R. P. McLaughlin and C. A. Waring. 1914, 519 pp.,	
13 illustrations, 83 figs. [18 plates in accompanying folio.]	
**Bulletin No. 70. Mineral Production for 1914, with County Maps and	
Mining Laws. 184 pp**Bulletin No. 71. Mineral Production for 1915, with County Maps and	
**Bulletin No. 71. Mineral Production for 1915, with County Maps and Mining Laws, by Walter W. Bradley. 193 pp., 4 illustrations	
Bulletin No. 72. The Geologic Formations of California, by James Perrin	
Smith. 1916, 47 pp	.25
Reconnaissance Geologic Map (of which, Bulletin 72 is explanatory), in 23 colors. Scale: 1 inch equals 12 miles. Mounted	2.50
in 23 colors. Scale: 1 inch equals 12 miles. Mounted10-37083	2,00

BULLETINS—Concluded.

Asterisks (**) indicate the publication is out of print.	
**Bulletin No. 73. First Annual Report of the State Oil and Gas Supervisor of California, for the fiscal year 1915-16, by R. P. McLaughlin.	Price
278 pp., 26 illustrations	
Maps, by Walter W. Bradley. 179 pp., 12 illustrations**Bulletin No. 75. United States and California Mining Laws, 1917. 115 pp.,	Free
Bulletin No. 76. Manganese and Chromium in California, by Walter W. Bradley, Emile Huguenin, C. A. Logan, W. B. Tucker and C. A.	
Waring, 1918. 248 pp., 51 illustrations, 5 maps, paper	\$0.50
Bureau, 1880–1917, by E. S. Boalich. 44 pp., paper Bulletin No. 78. Quicksilver Resources of California, with a Section on	Free
Metallurgy and Ore-Dressing, by Walter W. Bradley, 1918. 389 pp., 77 photographs and 42 plates (colored and line cuts), cloth	1.50
Bulletin No. 79. Magnesite in California. (In preparation.) Bulletin No. 80. Tungsten, Molybdenum and Vanadium in California. (In preparation.)	
Bulletin No. 81. Foothill Copper Belt of California. (In preparation.) **Bulletin No. 82. Second Annual Report of the State Oil and Gas Supervisor, for the fiscal year 1916-1917, by R. P. McLaughlin, 1918. 412 pp.,	
31 illustrations, cloth	
Maps, by Walter W. Bradley. 179 pp., paper	Free
617 pp., 28 illustrations, cloth**Bulletin No. 85. Platinum and Allied Metals in California, by C. A. Logan,	
1919. 10 photographs, 4 plates, 120 pp., paper	.50
Bulletin No. 86. California Mineral Production for 1918, with County Maps, by Walter W. Bradley, 1919. 212 pp., paper**Bulletin No. 87. Commercial Minerals of California, with notes on their	Free
uses, distribution, properties, ores, field tests, and preparation for market, by W. O. Castello, 1920. 124 pp., paper	
Bulletin No. 88. California Mineral Production for 1919, with County Maps, by Walter W. Bradley, 1920. 204 pp., paper	Free
**Bulletin No. 89. Petroleum Resources of California, with Special Reference to Unproved Areas, by Lawrence Vander Leck, 1921. 12 figures, 6	4.05
photographs, 6 maps in pocket, 186 pp., cloth————————————————————————————————————	1.25
Maps, by Walter W. Bradley, 1921. 218 pp., paperBulletin No. 91. Minerals of California, by Arthur S. Eakle, 1923, 328 pp.,	Free
Bulletin No. 92. Gold Placers of California, by Chas. S. Haley, 1923. 167 pp., 36 photographs and 7 plates (colored and line cuts, also geologic	1.00
map), cloth Extra copies of the Geologic Map (in 4 colors) Bulletin No. 93. California Mineral Production for 1922, by Walter W.	1.50 .50
Bradley, 1923 Bulletin No. 94. California Mineral Production for 1923, by Walter W.	Free
Bradley, 1924	Free
PRELIMINARY REPORTS.	
Asterisks (**) indicate the publication is out of print.	Price
**Preliminary Report No. 1. Notes on Damage by Water in California Oil	11108
Fields, December, 1913. By R. P. McLaughlin. 4 pp**Preliminary Report No. 2. Notes on Damage by Water in California Oil Fields, March, 1914. By R. P. McLaughlin. 4 pp	
Preliminary Report No. 3. Manganese and Chromium, 1917. By E. S. Boalich. 32 pp.	

PRELIMINARY REPORTS-Continued.

Asterisks (**) indicate the publication is out of print. Price Preliminary Report No. 4. Tungsten, Molybdenum and Vanadium. By E. S. Boalich and W. O. Castello, 1918. 34 pp. Paper_____ Free Preliminary Report No. 5. Antimony, Graphite, Nickel, Potash, Strontium and Tin. By E. S. Boalich and W. O. Castello, 1918. 44 pp. Paper. Free Preliminary Report No. 6. A Review of Mining in California During 1919. Fletcher Hamilton, 1920. 43 pp. Paper...**Preliminary Report No. 7. The Clay Industry in California. By E. S. Boalich, W. O. Castello, E. Huguenin, C. A. Logan, and W. B. Tucker, Free 1920. 102 pp. 24 illustrations. Paper____ Preliminary Report No. 8. A Review of Mining in California During 1921, with Notes on the Outlook for 1922. Fletcher Hamilton, 1922. 68 pp. Paper__ MISCELLANEOUS PUBLICATIONS. Asterisks (**) indicate the publication is out of print. **First Annual Catalogue of the State Museum of California, being the collection made by the State Mining Bureau during the year ending April 16, 350 pp.____ **Catalogue of books, maps, lithographs, photographs, etc., in the library of the State Mining Bureau at San Francisco, May 15, 1884. 19 pp.____ **Catalogue of the State Museum of California, Volume II, being the collection made by the State Mining Bureau from April 16, 1881, to May 5, 1884. 220 pp.___ **Catalogue of the State Museum of California, Volume III, being the collection made by the State Mining Bureau from May 15, 1884, to March 31, 1887. 195 pp.____ **Catalogue of the State Museum of California, Volume IV, being the collection made by the State Mining Bureau from March 30, 1887, to August 20, 1890. 261 pp.____ **Catalogue of the Library of the California State Mining Bureau, September 1, 1892. 149 pp.___ **Catalogue of West North American and Many Foreign Shells with Their Geographical Ranges, by J. G. Cooper. Printed for the State Mining Bureau, April, 1894____. **Report of the Board of Trustees for the four years ending September, 1900. 15 pp. Paper_____ Bulletin. Reconnaissance of the Colorado Desert Mining District. By Stephen Bowers, 1901. 19 pp. 2 illustrations. Paper_____ Free Commercial Mineral Notes. A monthly mimeographed sheet, beginning April, 1923 _____ Free MAPS. Registers of Mines With Maps. Asterisks (**) indicate out of print. **Register of Mines, with Map, Amador County

**Register of Mines, with Map, Butte County

**Register of Mines, with Map, Calaveras County

**Register of Mines, with Map, El Dorado County

**Register of Mines, with Map, Inyo County

**Register of Mines, with Map, Kern County

**Register of Mines, with Map, Lake County

**Register of Mines, with Map, Mariposa County

**Register of Mines, with Map, Nevada County

**Register of Mines, with Map, Placer County

**Register of Mines, with Map, Placer County

**Register of Mines, with Map, Placer County

**Register of Mines, with Map, San Bernardino County

**Register of Mines, with Map, San Diego County

**Register of Mines, with Map, San Diego County

**Register of Mines, with Map, San Diego County

**Register of Mines, with Map, San Barbara County

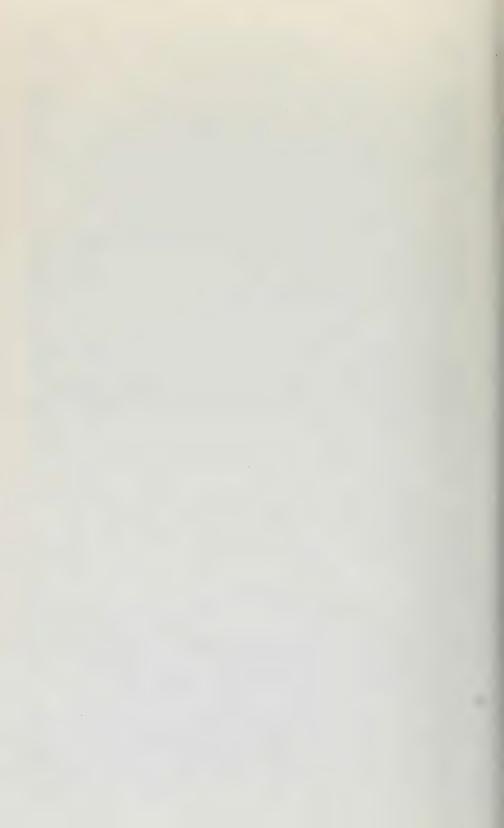
MAPS—Continued.	
Asterisks (**) indicate the publication is out of print.	
**Register of Mines, with Map, Shasta County **Register of Mines, with Map, Sierra County **Register of Mines, with Map, Siskiyou County **Register of Mines, with Map, Trinity County **Register of Mines, with Map, Tuolumne County	
OTHER MAPS.	
Asterisks (**) indicate the publication is out of print.	
**Map of California. Showing Mineral Deposits (50 x 60 in.)— Map of Forest Reserves in California— Mounted	\$0.50
**Unmounted	
**Mineral and Relief Map of California	
**Map of El Dorado County, Showing Boundaries, National Forests	
Map of Madera County, Showing Boundaries, National ForestsMap of Placer County, Showing Boundaries, National Forests	
**Map of Shasta County, Showing Boundaries, National Forests	
**Map of Sierra County, Showing Boundaries, National Forests	
**Map of Siskiyou County, Showing Boundaries, National Forests **Map of Tuolumne County, Showing Boundaries, National Forests	
**Map of Mother Lode Region	
**Map of Desert Region of Southern California	
Map of Minaret District, Madera County Map of Copper Deposits in California	.20
**Map of Calaveras County	
Map of Plumas County	.25
**Map of Trinity County	.25
Geological Map of Inyo County. Scale 1 inch equals 4 miles	.60
Map of California accompanying Bulletin No. 89, showing generalized classi-	
fication of land with regard to oil possibilities. Map only, without Bulletin	.25
Geological Map of California, 1916. Scale 1 inch equals 12 miles. As	
accurate and up-to-date as available data will permit as regards topography and geography. Shows railroads, highways, post offices and other towns. First geological map that has been available since 1892, and shows geology of entire state as no other map does. Geological details	
lithographed in 23 colors. Mounted	2.50
Topographic Map of Sierra Nevada Gold Belt, showing distribution of auriferous gravels. In 4 colors	.50
OIL FIELD MAPS.	
These maps are revised from time to time as development work	
advances and ownerships change.	
Map No. 1—Sargent, Santa Clara County Map No. 2—Santa Maria, including Cat Canyon and Los Alamos	.75
Man No. 3—Santa Maria, including Casmalia and Lompoc	.75
Map No. 4—Whittier-Fullerton, including Olinda, Brea Canyon, Puente	
Map No. 5—Whittier-Fullerton, including Whittier, West Coyote, and Montebello	.75
Map No. 6—Salt Lake, Los Angeles County	.75
Map No. 7—Sunset and San Emido and Kern County	.75
Map No. 8—South Midway and Buena Vista Hills, Kern County Map No. 9—North Midway and McKittrick, Kern County	.75
Map No. 10—Belridge and McKittrick, Kern County	.75
Map No. 11—Lost Hills and North Belridge, Kern County	.75
Map No. 12—Devils Den, Kern County	.75

OIL FIELD MAPS-Continued.

Map	No.	13—Kern River, Kern County	\$0.75
Map	No.	14—Coalinga, Fresno County	1.00
Map	No.	15—Elk Hills, Kern County	.75
Map	No.	16—Ventura-Ojai, Ventura County	.75
Map	No.	17-Santa Paula-Sespe Oil Fields, Ventura County	.75
Map	No.	18—Piru-Simi-Newhall Oil Fields	.75
Map	No.	19-Arroyo Grande, San Luis Obispo County	.75
Map	No.	20-Long Beach Oil Field	1.00
Map	No.	21-Portion of District 4, Showing Boundaries of Oil Fields, Kern	
		and Kings counties	.75
Map	No.	22-Portion of District 3, Showing Oil Fields, Santa Barbara	
		County	.75
Map	No.	23—Portion of District 2, Showing Boundaries of Oil Fields,	
		Ventura County	.75
Map	No.	24—Portion of District 1, Showing Boundaries of Oil Fields, Los	
		Angeles and Orange counties	.75
		26—Huntington Beach Oil Field	.75
		27—Santa Fe Springs Oil Field	.75
A		28—Torrance, Los Angeles County	.75
		29—Dominguez, Los Angeles County	1.00
Map	No.	30—Rosecrans, Los Angeles County	1.00

DETERMINATION OF MINERAL SAMPLES.

Samples (limited to three at one time) of any mineral found in the state may be sent to the Bureau for identification, and the same will be classified free of charge. No samples will be determined if received from points outside the state. It must be understood that no assays, or quantitative determinations will be made. Samples should be in lump form if possible, and marked plainly with name of sender on outside of package, etc. No samples will be received unless delivery charges are prepaid. A letter should accompany sample, giving locality where mineral was found and the nature of the information desired.





THE STATE MINING BUREAU

CORDIALLY INVITES YOU TO VISIT
ITS VARIOUS DEPARTMENTS MAINTAINED
FOR THE PURPOSE OF FURTHERING
THE DEVELOPMENT OF THE

MINERAL RESOURCES OF CALI-FORNIA

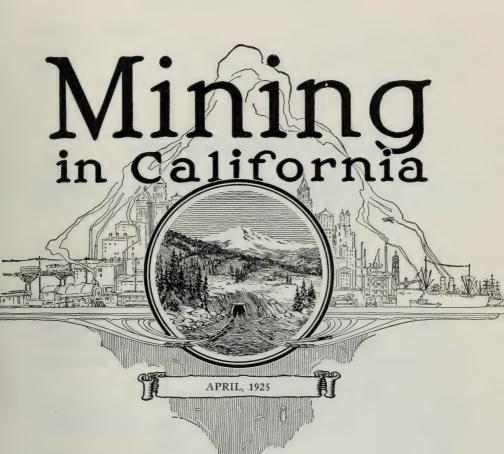
At the service of the public are the scientific reference library and reading room, the general information bureau, the laboratory for the free determination of mineral samples found in the state, and the largest museum of mineral specimens on the Pacific Coast. The time and attention of the State Mineralogist, as well as that of his technical staff, is also at your disposal.

Office hours: 9 a.m. to 5 p.m. daily.
Saturday, 9 a.m. to 12 m.

LLOYD L. ROOT.

State Mineralogist.

Third floor, Ferry Building, San Francisco, Cal.
Branch Offices: Pacific Finance Building, Los
Angeles; Chamber of Commerce Building,
Sacramento, Bakersfield, Taft, Coalinga.
Santa Maria, and Santa Paula.



PUBLISHED QUARTERLY

CALIFORNIA STATE MINING BUREAU

> FERRY BUILDING SAN FRANCISCO

CALIFORNIA STATE MINING BUREAU.

EXECUTIVE AND TECHNICAL STAFF

LLOYD L. ROOT State Mineralogist

WALTER W. BRADLEY
Deputy State Mineralogist

MINING DIVISION

C. A. LOGAN, District Mining Engineer	-	-	-	-	Sacramento
C. McK. Laizure, District Mining Engineer -	-	-	-	-	San Francisco
W. Burling Tucker, District Mining Engineer	-	-	-	-	Los Angeles
FRANK SANBORN, Mineral Technologist	-	-	-	-	San Francisco

DEPARTMENT OF PETROLEUM AND GAS

R. D. Bush, State Oil and Gas Supervisor - - - - San Francisco

Note.—A detailed report of the activities of the Department of Petroleum and Gas is issued monthly by the State Mining Bureau, entitled 'Summary of Operations, California Oil Fields.'

CALIFORNIA STATE MINING BUREAU

FERRY BUILDING, SAN FRANCISCO

LLOYD L. ROOT

State Mineralogist

Vol. 21

APRIL, 1925

No. 2

CHAPTER OF

REPORT XXI OF THE STATE MINERALOGIST

COVERING

MINING IN CALIFORNIA

AND THE

ACTIVITIES OF THE STATE MINING BUREAU



CALIFORNIA STATE PRINTING OFFICE JOHN E. KING, State Printer SACRAMENTO, 1925

CONTENTS.

	Page
DISTRICT REPORTS OF MINING ENGINEERS	135
Sacramento Field Division	135
San Francisco Field Division	
Los Angeles Field Division	223
Oil Field Development Operations	246
SPECIAL ARTICLES	251
California Foundry Sands	251
ADMINISTRATION DIVISION	258
DIVISION OF MINERALS AND STATISTICS	259
Statistics	2 59
Museum	266
Laboratory	266
LIBRARY	267
PRODUCERS AND CONSUMERS	273
EMPLOYMENT SERVICE	274
BUREAU PUBLICATIONS	I



The State Mining Bureau is maintained for the purpose of assisting in all possible ways in the development of California's mineral resources.

As one means of offering tangible service to the mining public, the State Mineralogist for many years has issued an annual or a biennial report reviewing in detail the mines and mineral deposits of the various counties.

The weak point in work of this character has been that the results of field investigations were so long in preparation that they had lost much of their usefulness by the time they finally appeared in print.

As a progressive step in advancing the interests of the mineral industry, publication of the Annual Report of the State Mineralogist in the form of monthly chapters was begun in January, 1922, and continued until March, 1923.

Owing to a lack of funds for printing, quarterly publication was

begun in September, 1923.

For the same reason, beginning with the January, 1924, issue, it has been necessary to charge a subscription price of \$1 per calendar year, payable in advance; single copies, 25 cents apiece. 'Mining in California' will continue to be sent without charge to our exchange list, including schools and public libraries, as are also other publications of the State Mining Bureau.

Pages are numbered consecutively throughout the year and an index to the complete reports is included annually in the closing number.

Such a publication admits of several improvements over the old method of procedure. Each issue contains a report of the current development and mining activities of the state, prepared by the district mining engineers. Special articles dealing with various phases of mining and allied subjects by members of the staff and other contributors are included. Mineral production reports formerly issued only as an annual statistical bulletin are published herein as soon as returns from producers are compiled. The executive activities, and those of the laboratory, museum, library, employment service and other features with which the public has had too little acquaintance also are reported.

While current activities of all descriptions will be covered in these chapters, the Bureau will not discontinue its practice of issuing from time to time technical reports on special subjects. A list of such reports now available is appended hereto, and the names of new bulle-

tins will be added in the future as they are completed.

The chapters will be subject to revision, correction and improvement. Constructive suggestions from the mining public will be gladly received, and are invited.

The one aim of the Mining Bureau is to increase its usefulness and to stimulate the intelligent development of the wonderful, latent resources of the State of California.

DISTRICT REPORTS OF MINING ENGINEERS.

In 1919-1920 the Mining Department was organized into four main geographical divisions, with the field work delegated to a mining engineer in each district working out from field offices that were established in Redding, Auburn, San Francisco and Los Angeles, respectively.

This move brought the Bureau into closer personal contact with operators, and it has many advantages over former methods of con-

ducting field work.

To continue this system most effectively with the limited funds available for the present biennium, the Redding and Auburn field offices were

consolidated and moved to Sacramento on June 1, 1923.

The boundaries of each district were adjusted and the counties now included in each of the three divisions, and the locations of the branch offices, are shown on the accompanying outline map of the state. (Frontispiece.)

Reports of mining activities and development in each division, prepared by the district engineer, will continue to appear under the proper

field division heading.

Although the petroleum industry is but little affiliated with other branches of mining, oil and gas are among the most valuable mineral products of California, and a report by the State Oil and Gas Supervisor on the current development and general conditions in the state's oil fields is included under this heading.

New County Reports.

The series of separate reports on the mines and mineral resources of the different counties, that together comprise the State Mineralogist's Reports XIV to XVII, inclusive, in the case of many of the counties have become exhausted. Those still in stock are in need of revision. Therefore, beginning with the January, 1925, issue of 'Mining in California,' the district engineers' reports are in the form of a complete general report on the mines and mineral resources in one or more of the counties in each district.

This program will be followed in succeeding numbers of the quarterly

until each county in the state has been covered.

SACRAMENTO FIELD DIVISION.

C. A. LOGAN, Mining Engineer.

CALAVERAS COUNTY.

Geography.

Calaveras County lies on the west slope of the Sierra Nevada Mountains, the elevation ranging from 400 feet above sea level where it joins San Joaquin County on the west, to 8000 feet where the eastern boundary rests on the summits of the Sierras adjoining Alpine. Bounded on the north by Amador County and on the south by Tuolumne, it shares with them the advantage of a climate where snow seldom falls and practically never lies below 2500 feet elevation, and where mining may

be carried on throughout the year under ideal weather conditions. The county is drained by Mokelumne, Stanislaus and Calaveras rivers, the branches of the former reaching into the highest mountains.

Timber, Transportation, Power and Water.

The eastern part of the county contains thousands of acres of timber, much of it held by large companies but partly in national forests

and not yet tapped by a railroad.

Three railroad branches enter the county—Angels Branch of the Sierra Railway Company of California, extending from Jamestown in Tuolumne County, and connecting with trunk lines at Oakdale; and branches of the Southern Pacific, extending from Lodi to Valley Spring, and from Stockton to Milton. The first named serves the mines of the Melones, Carson Hill, Angels Camp, Murphy, Valleeito and adjoining districts. Freight and supplies for San Andreas, Mokelumne Hill, West Point and other districts come via Valley Spring, and the Milton branch serves the copper and gold mines in the southwestern part of the county. A good automobile highway connects San Andreas, the county seat, with the valley system of concrete state highways, via Valley Spring. A good dirt road passable for automobiles all the year, crosses the county from Jackson to Melones, with branches to all the outlying districts which for the most part are accessible by automobile at all seasons.

Electric power is supplied to all of the principal mining districts, the Angels Camp, Murphy and nearby districts having service from both Utica Mining Company and Pacific Gas and Electric Company; the latter company doing most of the business in the northern part of the

county.

The increasing demand for water and the necessity for its conservation have been brought home to the people of the county by the action of the East Bay Utilities district which has taken steps to secure a municipal water supply for the east bay cities partly from Mokelumne River, and the plans of the city of Stockton to put up a flood control dam on Calaveras River west of San Andreas. Litigation is in progress at present between the city of Stockton and some landowners of Calaveras County regarding value of land desired for dam purposes, and the whole question of the final disposition of water supplies is of vast importance to all the people of the county.

Mineral Resources.

While the county's mineral resources are varied, the gold mines have been the principal source of wealth. As shown by the table of mineral production, herewith, the gold mines of the county have a recorded production during the past 44 years of over \$54,000,000. Annual gold yield has fallen below one million dollars only twice in the past 32 years, during which time the deep quartz mines have been the chief contributors. In spite of pessimistic predictions and the closing of old mines, those best acquainted with the county can not help being hopeful for the future of mining.

Next to gold, copper has been the principal product with a total output estimated at about \$25,000,000, including the production from

the copper mines between 1861–69, for which exact figures are not available, but which is estimated at about \$10,000,000 based upon incomplete figures for the output of the Union, Keystone and Napoleon mines during that period. The production since 1894 has been worth about \$16,000,000.

MINERAL PRODUCTION OF

	Gold,	Silver,	Copp	per	Mineral pai	nt (ochre)	Clay		
Year	value	value	Pounds	Value	Tons	Value	Tons	Value	
880	\$320,865	\$643	(1)						
881	800,000	1,200							
882	670,000	1,=00							
002	500,000								
883	500,000								
884	485,000	0.550							
.885	527,538	2,558							
886	639,457	4,926							
.887	640,417	1,477							
888	580,000	1,500							
889	592,243	1,071							
890	618,821	2,499							
891	738,883	4,860							
892	794,531	24,441							
893	1,669,192	122							
894	2,119,365	5,183	654,866	\$64,951	115	\$2,530			
895	1,717,916	77	175,895	16,925					
896	1,546,398	500	87,557	8,990					
897	1,439,861	1,745			150	2,400			
898	1,019,023	3,462	18,400	2,052	100	225			
899	1,265,564	9,813	165,484	27,586					
900	1,649,126	80,762	980,934	150,585	400	3,800			
901	2,024,685	44,687	1,701,389	268,000	125	500			
902	2,072,939	46 934	2,087,501	251,062	259	778			
902	1,904,125	46,234 68,280	2,246,675	297,263	200	1,000			
903	1,904,120	65 611	2,592,124	414,399	70	385	100	\$10	
904	1,789,184	65,611	2,392,124	414,599	1 40	900	100	911	
	1 000 010	70.050	0.000.010	F70 000	270	1 000	40	20	
905	1,836,816	78,859	3,666,810	572,022	379	1,900	40	30	
1906	1,644,234	74,099	5,082,320	956,315			50	25	
				200 200					
1907	1,097,974	54,420	3,941,883	609,203					
1908	1,378,511	62,727	4,804,446	555,704	50	250	25	28	
1909	1,440,511	71,418	5,438,908	690,632			100	50	
1910	1,440,511 1,147,705	82,866	7,345,321	778,369 773,769			30	28	
1911	1.112.315	67.032	6.190.153	773,769			50	20	
1912	1,112,315 962,145	67,032 70,748	6,125,415	1,010,693			4,281	4,48	
1012	002,110	*******	0,120,110	-,020,000					
1913	1,175,208	61,076	5,063,187	784,794	28	190	2,000	4,50	
1914	1,336,875	60,442	4,468,998	594,377			280	28	
1915	1,391,134	53,298	4,031,149	705,451	(2)				
1916	1,356,120	83,643	6,099,509	1,500,479					
1917	1,471,442	87,984	7,720,861	2,107,795	(2)				
1918	871,263	84,150	6,762,882	1,670,432					
1919	1,550,574	35,876	2,049,330	381,175					
1920	1,439,745	16,701	2,112,186	388,642					
1921	1,495,758	10,232	(2)						
1922	1,413,465	11,648					(2)		
1923	1,205,784	7,316	1,598,776	235,020			(2)		
127.603	1,200,704	1,010	1,000,110	200,020			1 /		
					-			\$11,0	

¹The Union Mine at Copperopolis was a producer as early as 1861, but there are no detailed, annual figures available for Calaveras County earlier than here shown.

*See under 'Unapportioned.'

*Includes clay (pottery), copper, gems.

4Includes clay (pottery), crystal quartz, lead, platinum.

CALAVERAS COUNTY, 1880-1923.

Mineral water		vater Limestone		Quartz	Miscellaneous and unapportioned			
Gallons	Value	Tons	Value	crystals, value	Amount	Value	Substance	
				@19 000	717 tons	e2 502	Pyrites.	
				\$18,000 17,500	717 tons	\$3,583	1 311005.	
				11,000				
					,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			
					3,500 bbls.	5,500	Lime. Chromite.	
		3,087	\$15,430	10,000	25 tons 20 tons	375 300	Chromite.	
		3,994	7,635	10,000	1 40 tons	280	Chromite.	
					13.9 ozs.	250	Platinum.	
		6,872	16,955	10,000				
		14,165	31,446	10,000		eso 075	Unapportioned, 1900-1909.	
		4,590 6,283	16,987			\$50,075	Chapportioned, 1900-1909.	
10,000	\$5,000	3,943	11,987 16,976 11,733		220 lbs.	10	Lead.	
7,528	3,764						~	
					2,500 lbs.	25	Graphite.	
11,500	5,500	2,000	1,400		7,006 lbs.	308	Lead. Other minerals.	
					650 tons	9,900 4,550	Chromite.	
15,508	6,517				290 tons	2,618	Fuller's earth.	
,	-,				30 lbs.	1	Lead.	
					9 ozs.	294	Platinum.	
15,343	5,752				163 lbs.	1,900	Lead. Miscellaneous stone.	
10,010	0,102					4,350	Asbestos, fuller's earth, mineral paint	
							platinum, silica.	
					1,636 tons	12,570	Chromite.	
10 055	7.005				7,238 lbs. 54 ozs.	499	Lead. Platinum.	
18,255	7,025				94 OZS.	2,453 2,503	Miscellaneous stone.	
						300	Other minerals.	
					1,613 tons	34,245	Chromite.	
10.00#	W 000				6,395 lbs.	550	Lead.	
16,985	7,009				20 ozs.	1,433 2,700	Platinum. Miscellaneous stone.	
						3,992	Clay, fuller's earth, mineral paint	
							Clay, fuller's earth, mineral paint silica, zinc.	
40.6					3,830 tons	159,453	Chromite.	
10,938	6,069				10 ozs.	598	Platinum.	
						420 2,067	Miscellaneous stone. Asbestos and lead.	
					2.019 lbs.	107	Lead.	
4,384	1,034				8 ozs.	1,076	Platinum.	
						600	Miscellaneous stone.	
					20 fine ozs.	8,116 2,002	Other minerals. Platinum.	
5,120	512			(2)	20 line ozs.	2,002	Miscellaneous stone.	
0,223	012					30,048	Quartz crystals and lead.	
					12 fine ozs.	876	Platinum.	
2,809	791					17,527	Miscellaneous stone.	
					22 fine ozs.	2,150	Copper and lead. Platinum.	
1,914	639				ZZ fine ozs.	35,590	Stone, miscellaneous.	
						39,391	Other minerals.3	
1,626	569			(2)	{	39,825	Stone, miscellaneous.	
						9,605	Other minerals.4	

Among other minerals which have been produced may be noted silver, produced as a by-product of gold and copper mining; limestone, mineral paint, clay, mineral water, rock crystal, (quartz) chromite and miscellaneous stone.

Geology.

The Neocene shore-line as indicated by the Ione formation, covered the county from Lancha Plana through Valley Spring to Jenny Lind, and southward to Milton. The most westerly of the lode mining districts are the Hog Mountain-Gopher Range copper mining district, where copper ores occur in diabase and allied rocks, near the southwest corner of the county, and the Campo Seco copper district, where similar ores occur in amphibolite schist. In a depression called Salt Spring Valley, between the older crystalline rocks of Gopher Ridge and Bear Mountains, lies a belt of black Mariposa slate with interbedded lenses of amphibolite, with important copper deposits, which conform in strike

with the direction of schistosity of the enclosing rocks.

The Mother Lode belt of black Mariposa slate enters the county at Middle Bar, but aside from the Gwin Mine, which had reached a depth of 2850 feet before it was closed several years ago, little deep mining has been done in this district, though numerous quartz mines have been opened to depths of less than 1000 feet. There are many prominent veins in the granodiorite area of Mokelumne Hill, but the main belt passes southeast, a line of fissuring having passed into the amphibolite schist, in which rock were found the deep mines of Angels Camp and Carson Hill. This belt of mines is characterized by 'free milling' ores carrying two to four per cent of auriferous pyrite, with some telluride ores at Carson Hill. Further notes on the geology of this district are given under Carson Hill Gold Mines, herein. The mines near Mokelumne Hill carry galena in addition to pyrite. The geology of these mines is exemplified by the Boston and Easyz Bird Mines, of which descriptions are given in this report. A west belt of gold mines lies west of Copperopolis in the amphibolite schist and black slate. The characteristics of these mines are illustrated by the accompanying reports on the Gold Knoll and Mountain King Mines.

The East Belt is a general name given to the gold-quartz mining districts in the great body of Calaveras (Carboniferous) rocks, lying east of the younger Mother Lode slate and east of the amphibolite schists accompanying the Mariposa slate. The Calaveras rocks are chiefly hard blocky siliceous and micaceous schists, quartzite, curly black slates and accompanying intrusive dikes, usually of basic character, which have had a very important effect on the gold-quartz deposits. The underlying granodiorite and more basic rocks of similar composition have been the sources of the ore-deposits and besides the dikes, this deeper rock is at times exposed over wider areas. One such area is the West Point district, where many small, rich ore shoots have been

mined.

As might be expected from ore deposits originating from such a source, and not far removed from it, the ores of the East Belt are more 'base' and more complex in character than those of the Mother Lode, and the increasing complexity may be traced northeast, as one travels toward the center of the granodiorite which forms the core of the Sierra Nevadas. The West Point ores contain pyrite, pyrrhotite,

galena, zincblende, marcasite, arsenopyrite, and chalcopyrite, in addition to free gold. The characteristics of East Belt mines are shown herein in greater detail under the descriptions of the Sheep Ranch and Washington mines.

Some geologists have asserted that the ore deposits at West Point are the fillings of joint planes, but many of the veins extend for considerable distances on the strike. However, a tabulation of the length of ore-shoots shows that a large number of them are less than 100 feet long. There has been no development deeper than 900 feet in this district and only prospecting is going on there now.

As regards the geology of the ancient river system, this has been covered in detail in references cited, so need not be mentioned here. It is believed that the notes on industrial mineral deposits cover the

geology sufficiently in each case.

*Bibliography of Publications on Geology and Mineral Resources of Calaveras County.

Lode mine descriptions, early operations: Mineral Resources West of the Rocky Mountains, from 1867 to 1875, edited by J. Ross Browne (1867–68) and Rossiter W. Raymond (1869–1875), published by the United States Treasury Dept.

Calif. State Min. Bur., State Mineralogist's Reports VI, VIII,

XI, XII.

Areal and structural geology: Calif. State Min. Bur. State Mineralogist's Report X (with map). U. S. Geol. Survey Geologic Folios 3, 5, 11 (reprint) and Geologic Folio 63., U. S. Geol. Survey 14th Report, part II, pp. 441–495.

Later Mining Operations, geology, metallurgy: Calif. State Min. Bur. State Mineralogist's Reports XIV, XVII, XIX, XX; Bull 18.

Placer Mining, Ancient Channels (in addition to above general references) U. S. Geol. Survey Prof. Paper 73., Calif. State Min. Bur. State Mineralogist's Report XII, Calif. State Min. Bur. Bull. 92.

Placer Mining (Dredging, gold and platinum) Calif. State Min.

Bur. Bull. 85.

^{*} All of the above publications are out of print and unobtainable except the XIVth and later reports of the State Mineralogist but reference copies of the older ones may be consulted at the San Francisco, Sacramento and Los Angeles offices of the State Mining Bureau and at the larger public libraries.

METALS.

COBALT.

The following notes were published in our quarterly, MINING IN California, for January, 1924, on this subject:

"During the past two years several samples of cobalt diarsenide (smaltite) with erythrite, have been brought to the attention of the Bureau. These apparently came from a single small prospect, which was visited in November, 1923. It is in the northwest quarter of Sec. 22, T. 4 N., R. 14 E. about a mile by trail from the Murphy-Sheep Ranch road and on top of a ridge at an elevation of over 3000 feet.

"A surface cut 15 feet long and 3 feet deep had been made on a stringer of the ore. This had been only a few inches wide between a mica schist footwall and a quartzite hanging wall, and had pinched out, so far as could be seen, both on the dip and strike. Only a few hundred pounds of ore had been found, but samples indicated it was of good grade. * * * "

indicated it was of good grade.

After the above notes were written, R. C. Johnson began work on the prospect and sank a shaft to a depth of 70 feet, in the course of which work small bunches and boulders of smaltite with arsenopyrite were encountered. The product, amounting to 3 or 4 tons, was lying on the dump and the property was idle in March, 1925. It is equipped with a small gasoline engine, blower and hoist, and is claimed by John Hauselt.

Casey & Bach Claim. Samples sent to the Bureau from Mokelumne Hill by Bert Hammel were identified as asbolite, or cobalt-bearing wad. A shaft was started on a small bunch of this mineral, mixed with quartz which was 16 inches wide at the surface. It pinched out at a depth of six feet, leaving only a seam less than an inch wide at a depth of 15 feet. John Casey and Carl Bach, both of Mokelumne Hill, are the present owners of the claim, which is one mile east of Mokelumne Hill

COPPER.

Calaveras County was the earliest copper producing county of consequence in the state but since the price of copper dropped in 1919, the copper mines here have been idle with the exception of the Penn Mining Company's property at Campo Seco, where the smelter was shut down April, 1920, after sixteen years' operation; and the Calaveras Copper Company's mines and smelter at Copperopolis, which resumed production in December, 1922, and are still running; besides which activities we have noted only short-lived efforts to operate a few of the smaller mines, such as the Napoleon and Quail Hill. The small copper mines of the county can only be operated at a profit when copper is bringing a fair price, the present market being too low.

The Bureau has had under way for some time the preparation of a bulletin on the 'Foothill Copper Belt' by Professor C. F. Tolman, Jr., and since the field work for that report was done there has been little new development (except as noted, post, and in Mining in California for April, 1924) so that detailed mention will not be made here of idle properties, for descriptions of which reference should be made to Report XIV, pp. 56-64; Report VIII, pp. 151-156; and Bulletin 50,

pp. 228-245.

As regards changes in the metallurgy of copper, it may be noted that in 1915 and 1916 experiments with the oil flotation process on a working scale began at the Napoleon and Union Mines (the latter now belonging to Calaveras Copper Company) and were so successful that this method was adopted. The ore at Copperopolis is chalcopyrite, carrying no gold and little silver. At Campo Seco and in the other mines the ores carry gold, silver and zinc in varying amounts, the gold and silver in the concentrate often being worth several dollars a ton, and the zinc content of the ore sometimes going as high as 15%. The amount of iron sulphide in the ore limits the grade of concentrate that can be obtained by oil flotation; at times it is hard to get over 10% copper in the concentrate and at the Calaveras Copper Company's plant the flotation concentrate averages about 18% copper after passing the Oliver filter.



Napoleon Copper Mine, on Hog Mountain, Calaveras County. The oldest commercial copper producer in the state.

Calaveras Copper Company. The property and plant were described by the writer in considerable detail in the quarterly, Mining in California, for April, 1924, pp. 76–80, inclusive, where a flow sheet of the concentrating and smelting plants was also shown.

In June, 1924, the new reverberatory furnace was put in operation and the blast furnace has not been in use since. Matte can now be drawn as desired and there are savings from the reduction of dust losses and from doing away with the use of coke. Oil is used for fuel.

About 125 tons of charge is handled daily.

In the 12th level from Discovery or Keystone shaft, a new orebody is reported 900 feet south of the shaft. Late in March, 1925, this was opened for a length of 150 feet and width of 18 feet, with the total length unknown. Another ore-shoot originally found in 1915, has been opened for a length of 100 feet on the 600 level of South shaft, and the 800 level is being run to reach it. The main ore-shoot is being developed on the 1450 level of Keystone shaft, and should be about 600 feet long, judging by results on the upper levels.

About 225 tons of ore is being mined and milled daily and an effort

is being made to reach capacity (400 tons daily) by June 1925.

GOLD

Gold quartz mining has been the principal source of mineral production in this county but this branch of mining has suffered here more than elsewhere during the past ten years because of high prices of labor and commodities. An analysis of production figures for the past ten years indicates that the gold produced from quartz mines has come

mainly from a few large properties.

The Utica Mine at Angels Camp was closed in 1918. Mining at the Melones Mine ceased in November, 1918, and milling was stopped in February, 1919. The Gold Cliff Mine of the Utica Mining Company was closed down in April, 1920. None of these mines had been worked out, but conditions had reached a point where operations at the first two named were not paying a profit under conditions then existing, and while the Gold Cliff was yielding a higher grade ore than the average for the district, and was paying some profit, the company felt that the ore might as well stay in the ground until costs receded.

Had it not been for the reopening of the Morgan Mine in 1919, Calaveras County would have fallen out of the list of leading gold

producers.

The following notes are intended to summarize the progress of gold quartz mining in the county during the past six years. The size and character of the quarterly publication does not permit a full report on the mines of the county, as a complete listing of even the patented claims would be beyond the scope of the bulletin, not to mention a discussion of the geology of the various mineral belts, claim maps, and other illustrative details which are desirable. Much of these data have been gathered, and it is hoped that they can be published later. Frequent references have been made to past publications which can be consulted at the Bureau's offices.

GOLD MINES (LODE).

Apex (Ford) Mine. Owners: Mrs. Ann Dower ¹/₃, Talton Hawes ²/₃. Under lease and option to Apex Mining Company, Dave Cavagnaro, manager, San Andreas. Prospecting work is continuing at this property, which adjoins the townsite of San Andreas. Work so far has been confined to the upper levels, where considerable new ground has been prospected. The old workings reached a depth of 700 feet.

The company has been greatly encouraged by results of prospecting in new ground during the past year. Work has been extended to the

three hundred level.

Bibl: State Mineralogist's Report XIV, p. 79; XX, p. 4.

Bachman Mine. Is in Secs. 10, 11, T. 3 N., R. 12 E.; 7 miles south of San Andreas near San Andreas and Angels Road and contains twenty acres. Owners: Constant Bund, Louis Costa, Antone Costa et al. Under lease and option to Joe King of San Andreas, et al who are prospecting it. There were two old shafts on the property, which were 75 feet and 478 feet deep respectively, on separate veins. Work has been resumed on the property within the past few months and electric power brought in. Joe King of San Andreas is in charge of work, which had reached a depth of 100 feet early in 1925.

Bence Mine. (Esmeralda Extension and Tellurium claims). Mrs. Minnie Hengen, owner, San Andreas. Comprises two full claims, unpatented, near Esmeralda, in Sec. 34, T. 4 N., R. 13 E. The property has lately been leased with option to J. Hildreth of Los Angeles. Development comprises several hundred feet of adit and a shaft 175 feet deep, all done years ago.

Bluejay Mine. Address Allen H. McCarty, Mokelumne Hill. In SW4 of Sec. 16, T. 5 N., R. 12 E. near North Fork of Calaveras River. James, George and Melvin Hamby are engaged in prospecting the claim through an adit 1800 feet long, most of which was driven years ago. Encouraging prospects are reported and operations may be expanded. There is an old 10-stamp mill, boarding house and other improvements on the claim.

Black Wonder Mine is 9.2 miles east of West Point. It has been described in the Bureau's bulletin Mining in California for January, 1922. A Gibson mill has been in operation in 1924–1925. R. W. Bender operating.

Boston Mine. (Formerly Esperanza or Boston Cons.) Owner: Boston Cons. Mines Co., 154 Sutter Street, San Francisco, care of S. L. Dairdson. Morning Star Mining Company lessee with option to purchase. Main office 244 Kearny Street, San Francisco. S. C. Tomsky, president and Theodore H. Segall, secretary. Mine superintendent, C. H. Page, Mokelumne Hill. Property is two and a half miles from Mokelumne Hill in Sec. 5, T. 5 N., R. 12 E. comprising Esperanza, Royder Placer and Mammoth patented claims and six other unpatended claims, 183 acres in all.

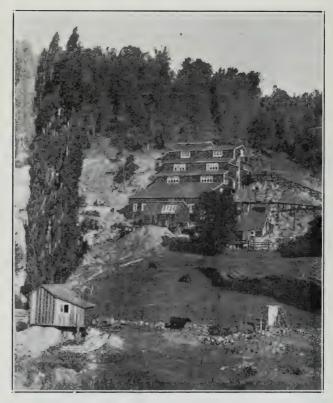
The property was worked in the '80's or earlier and had a 20-stamp mill in 1892, working surface ore. The shaft was sunk between 1893 and 1900, but the mine was idle from 1900 until 1912 when the mill burned down. The new mill was completed in July, 1920, and operations have been intermittent since.

The vein strikes north and dips 30° to 40° east, with a maximum width of 50 feet. It has been developed by a shaft 1000 feet deep, giving a vertical depth of 671 feet with levels called adit level (50 feet deep) 100, 300, 500, 700 and 950. Most of these except a part of adit level, 100 south and 950 level are inaccessible. On 100 level, the vein is 40 to 50 feet wide and is producing 20 tons of ore daily that should yield a small profit as it is cheaply mined. Just before the fire (March, 1925) another 20 tons daily was being mined in a raise 300 feet north of the shaft on 950 level. This is good looking sulphide ore, carrying pyrite and galena, and is near a pocket which yielded a few thousand dollars last summer.

No. 3 footwall crosscut on this level shows the footwall is a hard black dike, with a later layer of twisted marble lying between it and a schistose layer probably derived from diorite, the latter forming the intermediate footwall of the vein. A hanging wall crosscut and drifting north of the shaft shows ground-up quartz up to 10 feet wide, with successive layers of serpentine, limestone and black schist, the hanging wall of the series being a basic igneous rock, probably diorite, similar to the footwall. The face of the main adit north is in similar rock, the course having been turned northeast.

The present company operated the mill from December 1, 1920, until March 1, 1921, and from May to November, 1922, on low-grade material. It was again started early in March, 1925, and crushed about 50 tons a day until March 25, when a fire put the compressor out of commission, and mining was begun on the adit level. Here, early in April, three feet of ore on the hanging wall side of the 14-ft. vein, was giving good results in the mill.

The mill contains a rock breaker operated by 25-h. p. motor, 6' x 8' ball mill with 150-h. p. motor, plates, 4 Deister Plat-O concentrators,



Mill of Carson Hill Gold Mines, Inc., at Melones.

Ruth flotation outfit, cyanide tanks, Oliver filter and dewatering cone. Plating and concentration only are being done now. A total crew of 15 men is employed.

Carson Hill Gold Mining Co. Main office 55 Congress Street, Boston, Mass., is the holding company and Carson Hill Gold Mines, Inc., is the operating company, working Melones, Morgan, Calaveras and Chaparral Hill group of mines and adjacent claims extending from the northwest side of Carson Hill to Stanislaus River, and covering about 10,000 feet along the strike of the veins. The company owns the Morgan, Union, Kentucky, Iron Rock, Relief, Reserve, Enterprise, and Irvine and McMillan quartz mines, one-tenth interest in Finnegan Mine and other quartz claims and mineral rights on Carson Hill, a total of about 1100 acres.

Melones Mine was operated by Melones Mining Company from 1898 until November, 1918. The first 60 stamps (later increased to 120) were installed in 1901, and the mill was in steady operation until February, 1919. While there was considerable high-grade ore, the average grade milled was low on account of the method of mining, and the company reported at the time of stopping work that it was costing them about \$20.00 an ounce to produce gold. Before the war they claimed to be operating for \$1.60 per ton on an ore averaging \$2.00 to \$2.50 a ton.

The ore mined was principally a stringer lead carrying auriferous pyrite, in amphibolite schist on the footwall side of a massive quartz vein to the 1400 ft. level, and on the hanging wall side from there to 3500 level. The vein carried quartz, calcite, schist and some talc, and had a maximum width of 65 feet, and was stoped for an average of 25 to 30 feet wide. It strikes northwest and dips 70° to 1350 level, where the dip flattens to 50° northeast. At the 900 level, a fault (flat vein) striking N. 30° W. and dipping 30° to 45° NE. cuts the ore and 'bull' quartz vein and traverses the 'bull' quartz vein for about 200 feet on the dip, but did not displace the vein. Another fault or 'flat vein' of similar dip and strike intersected the 'bull' quartz vein at 1350 level and threw the lower section of vein 200 feet into the hanging wall. From there down, the ore was on the hanging wall of the 'bull' quartz yein, which as a rule is itself barren or low grade. On the 2500 level, the stope was 65 feet wide. From the surface to 1100 level, mining was done by means of an immense glory hole. The vein was stoped for a length of 480 feet on 200 level, 660 feet on 865 level, and 380 feet on 1100 level, and ore was taken out through the 1100 level tunnel which cut the vein 4000 feet from the portal. From this level a threecompartment winze was sunk to 3500 level. The mill particularly is described in detail in Report XIV of the State Mineralogist, pp. 95-96.

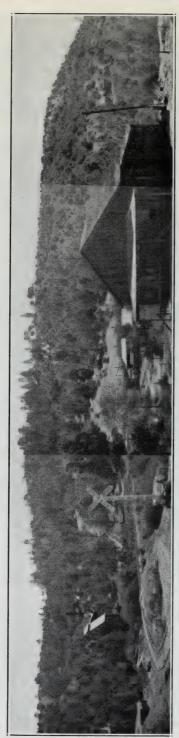
The mine was leased to Carson Hill Gold Mines, Inc., early in 1920 and then sold to them and has since been operated by that company. Melones Mining Company now retains only their hydro-electric

property.

The Morgan Mine was discovered in 1850 by Hance, who took in six partners, one of whom was named Morgan. The ore was so rich in gold that it is said cold chisels had to be used at times to cut it,¹ and the largest single piece of quartz gold ever mined was reported to have been found here.² Stories of the bonanza attracted thousands to the camp of Melones. The Morgan ore was worked in mortars and arrastras, and besides the \$2,800,000 reported to have been realized by the owners between February, 1850, and December, 1851, it was known that a great deal was stolen by the Mexican miners. In 1852, the mine was seized by a small army of outsiders who drove off the owners and operated the property for nine months, until removed by injunction.

After this romantic beginning, the mine passed through the usual periods of litigation, idleness and operation on a small scale, having lain idle for over ten years when reopened in 1918 by Carson Hill Gold Mines, Inc. During this latter period, Melones Mining Company had been working nearby, some of Melones workings having been separated

¹Raymond, R. W., Mines and Mineral Resources of the U. S. West of the Rocky Mountains, 1868. ²Tucker, W. B., State Mineralogist's Rept. XIV, p. 97. 1915.



The Panoramic view of Carson Hill, Calaveras County, looking south. Old glory hole of Melones Mines and Finnegan Mine on the left. upper workings of the Morgan mine in back of loading bin in left side of picture.

from the rich Morgan ore-shoot by the thickness of the 'bull' quartz vein.

High-grade milling ore was found in the Morgan Mine on the hanging wall side of the 'bull' quartz vein on the 300 level and was stoped up to 200 level. It was followed downward with good results. The vein, a branch of the Mother Lode, strikes nearly north and dips 50° to 70° E., and the ore-shoot pitched south. As originally worked in 1919, this ore-shoot was stoped for a length of from 140 to 200 feet and a thickness of over 30 feet, and during 1919, the mill heads averaged \$14.95 a ton. The hanging wall of this orebody is greatly altered amphibolite schist, and there was indeed no distinct hanging wall, as the orebody had evidently been formed by the mineral-bearing solution rising along the footwall, and altering and replacing the soluble minerals of the hanging wall to a sufficient extent to form ore, with the deposition of about 4% of sulphides, which proved to be worth about \$100 a ton as concentrate. Much of the good ore was characterized by graphite, and by a talcose gouge. The footwall of the orebody was the solid 'bull' quartz vein, six feet or more thick, followed by the lower-grade footwall amphibolite schist orebody, which had been previously worked.

The Morgan hanging wall ore-shoot has been worked to the 1450 Morgan level. It was stoped 350 feet long on the 550 level, 280 feet long on 675 level, 265 feet long on 865 level, 225 feet long on 1100 level and 315 feet long on 1300 level. The southerly pitch of the ore-shoot carried it into Melones Mine a little below the 1450 Morgan level. This shoot was the mainstay of the Morgan Mine. The faults or 'flat veins' mentioned under Melones Mine are termed the '675 flat vein' and '1100 flat vein' in the Morgan Mine. Both these veins are stoped, yielding low-grade ore, worth \$4.50 to \$5.00 a ton, and of a maximum width of 20 feet, though averaging 10 feet to 12 feet.

Melones Mining Company had previously mined on the hanging wall side from the 1350 to 3500 level. There was a so-called barren or lean zone from about 2170 feet for a depth of about 600 feet, where little ore was found. Carson Hill Gold Mines, Inc., sank a new internal shaft from the 3000 level 225 feet south of the bottom of Melones shaft, on a 57° incline to 4550 level, and opened levels 125 feet apart. Lately they have been working on the 3500, 3875, 4000, 4125, 4250, and 4375 levels. In March, 1925, ore was being stoped on the 4125, 4250 and 4375 levels and averaged 18 to 20 feet thick, with a southerly pitch still persisting.

The following figures show the average value of ore milled, and amounts recovered by this company since milling operations began in January, 1919, up to the end of 1924:

Year	$Average \\ recovery$	Tons	Recovered Value
1919 1920 1921 1922 1923	\$14.95 11.54 6.82 6.27	$\begin{array}{c} 111,662 \\ 175,666 \\ 183,733 \end{array}$	$\$992,149 \\ 1,093,900 \\ 1,067,247 \\ 1,035,757 \\ 995,332$

From 1921 onward, the mill handled an average of 15,000 tons a month, or more, except in 1924, when work was curtailed by water and power shortage.

The milling process consists of crushing the ore to 20-mesh with thirty 1250-lb. stamps, classifying, overflow going over plates and sand

to Hardinge mills for regrinding; thence over plates to Deister Simplex sand concentrators and Deister Plat-O sand tables. Average stamp

duty has reached as high as 18.44 tons a day.

The distribution of recovered gold was about as follows in a representative year on the lower-grade ore: Bullion 55%; concentrate 27.6%; sand and slime 17%. For the richer ores, mined in 1919–20 in the upper levels of the Morgan, the distribution of gold content was: In bullion, 65.58%; in concentrate, 23.01%; in sand and slime, 11.41%. The bullion was worth \$18.90 an ounce in 1919. Concentrate, sand and slime are eyanided. Recovery from concentrate averages 92%, as per contract; on sand and slime the average recovery has been about 68%. Tailing loss has ranged from \$1.26 per ton in 1919 to \$0.60 per ton in 1922.

Representative cost figures for operations at this group of mines are hard to arrive at, because work has been carried on under different conditions in different workings, as for example during 1922 when ore from the Morgan Mine was coming entirely from above the 1100 level, and that from Melones Mine from between 3600 and 4000 levels, with average costs representing rather wide extremes. Of a total mining cost of \$1.473 per ton crushed in 1922, the largest items were labor \$0.737 per ton, and explosives \$0.192 per ton. Timber, power, repairs and maintenance ranged from $3\frac{1}{2}\phi$ to $4\frac{1}{2}\phi$ each, per ton crushed (for

mining) and tools 6ϕ to $6\frac{1}{2}\phi$ a ton.

Cost of reducing the ore and marketing were as follows in 1922, per ton crushed:

Stamping, amalgamation, regrinding, concentration————————————————————————————————————	$0.663 \\ 0.013$

The mill handled an average of 15,300 tons a month that year, an average of 27.67 stamps giving an average duty of 18.44 tons a day

--- \$1.665

each.

The total crew employed at that time in Morgan and Melones mines was 232 men, of whom 185 to 190 were actually employed in mining.

Chapman (McGary) Mine. On McGary Ranch, in Railroad Flat district. This is one of the very old quartz mines developed 50 years ago by a shaft 210 feet deep, with drifts north and south from which considerable ore was stoped and milled. The mine was reopened by Goddard-McKay Mines Company of Sacramento in 1924. A ball mill was installed and some ore was milled, but early in 1925 the company failed to meet the terms of their option and quit work. Later in April, 1925, the surface plant was burned down for the second time since the reopening.

Calaveras Mine. This group of claims near Melones has been under lease and option for several years to Carson Hill Gold Mines, Inc., and has been prospected at intervals, with some production. The ore developed on the lower levels runs \$5 to \$7 a ton, and although the mine showed very good promise when being worked in 1919 and 1920, the company did not feel inclined to work it extensively at the time

as they had just opened and were exploiting the high-grade Morgan Mine ore-shoot. The Calaveras has therefore not been developed much since 1919. Up to 1923, the operators reported they had made a gross production of \$46,579 from the Calaveras, and during 1924 the property produced 5,282 tons of ore which was treated in the company's mill with its other ore.

The vein has been developed by an adit entering the hill near Melones and following the vein nearly north for 2000 feet or more; ahead of this, the vein outcrop was extensively prospected by trenching. The main adit is called 1000 level, all levels on this and adjoining properties worked by this company having been referred to the apex of the vein on the New Year claim on the summit of Carson Hill. From this adit, 950 feet from the portal, a winze was sunk and levels opened at 1123, 1250 and 1375 feet, from which several hundred feet of drifts were run, mostly north. The vein averages 15 feet wide, of which 7 feet is classed as ore. Both walls are amphibolite schist, the footwall swelling and the hanging-wall heavy, requiring close timbering and hard to hold open long. The old operations were through a shaft 600 feet deep, but recently nothing has been done in the worked-out area above 1000 level.

The Calaveras Mine has often been regarded as on the main Mother Lode, and the adjoining Morgan and Melones as being on a branch from the main lode. The distinction appears of little importance in the light of the developments and production of the last two named mines.

Bibl: State Mineralogist's Report, XVII, p. 421; XIV, p. 73; XIII, p. 99; X, pp. 56-57; XI, pp. 169-170. Bull. 18, p. 123.

Chaparral Hill Group. This property comprises seven patented claims and two millsites in Secs. 11, 14, T. 2 N., R. 13 E., 95 acres in all, on Chaparral Hill between Angels Camp and Carson Hill. Owners: Melvin C. Meeker, Jr., and Effie M. Meeker of Camp Meeker, Sonoma County, each one-third; Chaparral Hill Operating Company (subsidiary of Carson Hill G. M. Inc.) of Carson Hill, one-third.

During the past three years the Chaparral Hill Operating Company did considerable prospecting work on these claims, working through the nearby Hardy shaft. No important ore discoveries were reported.

Bibl: State Mineralogist's Report XIV, p. 73.

Demarest Mine. Owner: Demarest Gold Mining Company, care Lawrence Monte Verde, Altaville. Comprises one patented claim of 13.79 acres in Lot 39, in NE₄ of Sec. 16, T. 3 N., R. 12 E., with 129 acres of land adjoining in Secs. 9, 15, and 16. There is an old 5-stamp mill, hoist, boilers, engines, compressor and other old equipment on the claim. The property has been idle a number of years, but was formerly worked through a shaft 700 feet deep and made a fair production from the upper levels. It has lately been taken under option by A. J. Fazzi of the Jolly Tar Mining Co.

Bibl: State Mineralogist's Report XII, p. 92; XIV, p. 96. State Min. Bur. Bull. 18, p. 107.

Dominion Mining Organization, Inc., 306 Merchants Exchange Building, San Francisco, did some prospecting work the past three years on

a group of 22 unpatented quartz claims and other unpatented land in Sections 25, 26, 35 and 36, T. 7 N., R. 13 E.; Sec. 6, T. 6 N., R. 14 E., and adjoining parts of the West Point district, and also on several old mines including the Zacatera, Star of the West, Wide West, Modoc

and others, in the same district.

The company has planned to drive a long tunnel to tap a number of veins at a depth of 1000 feet below the bottoms of the old workings, which in most cases have not exceeded 200 feet. This tunnel work was temporarily stopped after going several hundred feet, and the project is idle for the time being. There is an air compressor, gas engine, shop and building on the property.

Easyz Bird Mine, Pacific Gold Mining and Milling Co., care Max Muller, Nogales, Arizona, owners. Under option March, 1925, to E. R. Abadie et al. It is three and a half miles by road from Mokelumne Hill, in W¹/₂ Sec. 6, T. 5 N., R. 12 E., on the south side of Mokelumne River. About 400 acres in unpatented land are held under option, including this old mine and adjoining claims.

Several of the claims have been worked in a small way by successive stock companies. Mine was in operation from 1898 to 1907, then from 1914 to 1917, since when it has been idle. No records of past output are available, but it is stated to have paid a small profit to some of the operators, and the last work is said to have paid a profit until costs

went up during the late war.

The Easyz Bird vein strikes N. 60° to 80° E. as shown by occasional croppings across the west half of section six, but does not outcrop continuously. Several faults, and a number of quartz veins, including the Challenge, Fraction, J. P. Morgan and other veins, intersect the main vein and ore-shoots have been mined at these intersections. The country rock is granodiorite, but underground relations could not be viewed as the mine was inaccessible at the time of visit. The main vein has a maximum width of 50 feet, with an average width of nine feet in the ore-shoots according to the mine map. It dips N. 45° W. The cross veins strike south to southeast and dip east.

Development consists of an inclined shaft 303 feet deep on the dip, a main adit level and levels at 50, 100 and 200 feet; the main adit is a crosscut 232 feet with a drift on the vein 695 feet east and 1020 feet

west. Besides this the 50 foot level was run 52 feet, the 100 foot level was drifted east 390 feet and west 307 feet, and an uncertain amount of work was done on the 200 foot level. Seven stopes, varying in length from 35 feet to 110 feet were worked above the main adit, which is 83 feet vertically below the collar. According to the mine map, the lower levels were run far enough to prove only two of these shoots, which were stoped a little on the 100-foot level. Two faults are mapped, one 60 feet east of the shaft, another 50 feet west of the shaft, which moved the vein north, looking east.

The mill includes a Knight crusher, bucket elevator, 6-foot ball mill, plates, Dorr classifier, four Callow cones, eight concentrators, and electric motors, and is in good condition.

Empire Mine lies south of Royal Consolidated Mine. Carries base ore, with high-grade concentrate. Bishop & Hobart, owners (?), San Francisco.

Finnegan Mine. This mine comprises two patented claims on the northeast slope of Carson Hill and contains 11.29 acres in Sec. 13, T. 2 N., R. 13 E. It adjoins Melones Mine on the same orebody that was worked by open cut so many years by the latter company. The principal production from the Finnegan has been obtained by the same method of mining, and the ore has been for the most part of similar low grade, being a mineralized schist and stringer lead 30 feet to 100 feet wide on the footwall side of a bull quartz vein. The open cut adjoins and forms a part of the old Melones glory hole, which for years stood open to a depth of 1100 feet, but caved in a year or so ago. The Finnegan workings however, have been shallow, less than 200 feet deep.

Since our Report XIV the property has been operated occasionally for short periods but production has been small. The plant was rebuilt in 1921 by Lewis, Gilman and Moore and the 10-stamp mill was last operated by Thos. C. Tarbat for himself and other owners during 1923—24. Early in January, 1925, the interest of Thos. C. Tarbat in the property was attached by the sheriff on account of a judgment rendered

in favor of Charles Valconesi.

Bibl: State Mineralogist's Report XIV, p. 79; XIII, p. 104; XII, p. 92; XVII, p. 421.

Fish Group. L. B. Fish, owner, Railroad Flat. Includes Stand-by Mine and Millsite, Lots 83, 83a in NE¹/₄ of Sec. 35, T. 6 N., R. 13 E., and Fish and Dellinger quartz claims. Prospecting has been going on and a 4-stamp prospecting mill has been installed.

Forest Creek Mining Company. Reported to have an adit 300 feet on a ledge from six inches to twenty-four inches wide, with high assays. Is in West Point district. D. Terhorst was president, Frank Aderhald, superintendent. Hauled in machinery but evidently quit. On Middle Fork of Mokelumne River. Resumption of operation was planned in April, 1925.

Gold Knoll Mining Company. This is a stock company formed to work prospects on the Womble Ranch, which includes the old Wilbur Womble Mine. The old mine is in the SW4 Sec. 29 and the present operations are in the NE4 Sec. 32, T. 2 N., R. 12 E., adjoining the old town of Hodson, 14 miles from the railroad station of Milton. There are 480 acres in the holdings. E. E. Schmitz, president, Herbert Schmitz, secretary. Office 925 Hearst Building, San Francisco, Alex-

ander Boyle, manager, 364 Bush Street, San Francisco.

The new shaft is 3000 feet southeast of the old one. It is 275 feet deep on the incline and besides the adit level, there is a No. 1 level 115 feet deep on the dip. The vein is a stringer lead in slate and schist, striking northwest and dipping 45° NE. with some outcrops of solid quartz. On the adit level, about 50 feet deep, 640 feet of crosscuts have been run and have blocked out a wide stringer lead in slate. It is oxidized and has yielded numerous good assays according to Boyle. An east crosscut on No. 1 level was run 234 feet into the hanging wall and had failed to cut this lead, and conditions are such as to indicate the possibility of either a tapering of the orebody, or a movement of the upper segment eastward. On the No. 1 level, a drift was run northwest 50 feet from the shaft, and a crosscut at the face was driven 15 feet northeast and 40 feet southwest. This shows the black slate

footwall, badly crumpled and twisted. The section of vein, which is stated by the manager to be of milling grade, is about 19 feet wide. A dike, completely altered, lies in the vein near the footwall. The immediate hanging wall is an altered dike, probably diabase or 'greenstone' originally, followed by slate and farther in the hanging wall by serpentine. The footwall gouge here has a normal dip, steeper than that of the hanging wall, and suggesting the possibility that the vein may be widening below. The bottom of the shaft was in black slate, in the footwall of the vein opened above.

Equipment here includes electric hoist, 350-cubic-foot air compressor, blacksmith shop and electric transformers taking power from P. G. and E. Company. The underground work has been done well and is in

good shape.

The old mine was worked by a glory hole 900 feet long, 50 feet wide and 100 feet deep, with a shaft reaching a depth of 185 feet, or 132 feet vertically. The pay-shoot worked is said to have been 450 feet long and 50 feet wide, and according to a former report of this Bureau, averaged \$3 in free gold and two per cent of low-grade concentrate. There is an old 15-stamp mill near the old shaft.

Bibl (for Wilbur Womble Mine): State Mineralogist's Report XIV, p. 113.

Hardy Mine. Owners: Estates of A. J. Hayward and W. S. Hobart each one-third et al., care Utica Mining Company, Angels Camp. Comprises the Hardy Mine, 6.19 acres, and McCreigh & Reed, 2.86 acres, in Secs. 11, 14, T. 2 N., R. 13 E., on the north slope of Chaparral Hill, 3 miles south of Angels Camp. Property was prospected in 1922–23 by Chaparral Hill Operating Company, an exploration company subsidiary to Carson Hill Gold Mines, Inc. It had formerly been worked through an adit 360 feet long and a winze, and had produced a number of good-sized pockets from a large white quartz vein, where it came in contact with porphyry. The old shaft, 170 feet deep, was used as an entry for the recent work.

Hawkins Group comprises 12 claims, some claimed by adverse owners, in SW¹/₄ Sec. 34, T. 6 N., R. 12 E., in Rich Gulch Mining district, on the south side of Mokelumne River. E. F. Hawkins, P. O. Box 371, Stockton, California, and wife are the principal owners of Hawkins Gold Mining Company. Claims are reached by road and trail from Mokelumne Hill and West Point road via Raymond Davis Ranch, and extend from an elevation of 1000 feet near the river to over 2000 feet on Altamont claim.

A number of veins in granodiorite have been prospected by trenches, open cuts and adits. The strike of veins varies from west to northwest. Bunker Hill and Bunker Hill No. 1 claims have been prospected by open cuts. On Bunker Hill No. 2 there is an adit 250 feet long. There is an old 5-stamp mill which might be repaired and operated by water power, on this claim. This mill is above the first two claims mentioned, but could be used in milling ore from the claims above on the slope.

On the Altamont, Twin Tunnel and L. G. M. claims a vein has been

prospected by open cuts.

Electric power is two miles distant and the Mokelumne Hill ditch crosses the upper claim 1000 feet above the river.

Indian Creek Gold Mining Co. George S. Walker, president. This company operated during 1924 on the Maria and Fortuna claims in Sec. 34, T. 4 N., R. 13 E., near Esmeralda. An adit had been repaired and advanced to a length of 400 feet during last July, but work was interrupted soon after by the death of the engineer in charge.

Lamphear Mine. Owner: Roanoke Mining Co., 2035 Oakland Ave., care L. S. Wetmore, Piedmont, California. Comprises Lot 46 and adjoining land in NE₄ of NW₄ of Sec. 18, T. 5 N., R. 12 E., a mile south of Mokelumne Hill. This property has been under lease and option to Lamphear Mining Company of Mokelumne Hill. Since the last report this company installed electric-power hoist with speed of 300 feet per minute, Gardner turbine pump, capacity 100 g. p. m.; and other equipment. The workings were unwatered after considerable difficulty, by combined baling and pumping, and were explored and sampled, but on account of lack of finances the company was unable to do much new work.

The Lamphear vein strikes northeast and dips 45° southeast, between an amphibolite schist footwall and slate hanging wall, and pinches and swells. It has been developed by an inclined shaft 300 feet deep in the footwall with a dip of 10° steeper than the vein. A level was turned at a depth of 115 feet and the vein was stoped 260 feet on the south and for an uncertain distance north. A crosscut at 180 feet showed a pinch in the vein, but at the 280 level, drifts were run 100 feet south and 70 feet north. The north drift is said to be in ore beginning 15 feet from the shaft and extending to the face where the vein is four and a half feet wide with two feet of gouge. Robert Irvine who was in charge of the last work, states the vein is six to eleven feet wide in the bottom and assays \$4.80 per ton on the north side, but is poor on the south. The ore carries $3\frac{1}{2}\%$ of concentrates, of which 1% is galena, and concentrates assay about \$65 a ton. The mine has a record of \$118,000 production.

The property was taken under lease and option April 24, 1925, from the Lamphear Mining Co. by parties who expect to reopen it at

once.

Maltos and Mexican Claims. J. Maltos, 1802 South San Joaquin Street, Stockton. They include 30 acres adjoining the Royal Mine at Hodson on the footwall side and contain a vein three feet to four feet wide which has produced some pockets and is thought by the owner to be the extension of the Mountain King vein. There is no equipment on the claims.

Mountain King Group consists of seven patented claims adjoining the Royal Mine on the northwest in Secs. 19 and 30, T. 2 N., R. 12 E., near Hodson and 12 miles from the railroad terminus at Milton.

Owner, R. B. Parks, 130 East Walnut Street, Stockton.

The Mountain King, Wm. K. Bulger and Last Chance claims cover a total length of 2844 feet on the lode. The footwall is black slate, and according to a report by Byron E. Rowe, from which the following notes are summarized, "the veins are in the amphibolite schists at the contact with the Mariposa slate, mineralization being controlled largely by numerous fractures and intrusions of small veins of quartz which traverse the amphibolite schists in all directions and exhibit heavy mineralization wherever contacting the vein."

The vein has a well-defined outcrop with a maximum width up to 50 feet, strikes N. 60° W. and varies in dip from 31° to 20° N.E. The vein is reported to be the same one worked near the line in the Royal Mine.

The principal shaft is a 28° incline 1044 feet deep, passing into the hanging wall schist in the lower section, due to steepening of the vein. Six levels were turned from this shaft, called one, two, four, five, six and nine. On each of levels one, two and four about 100 feet of drifting was done, and on level four a stope 28 feet long by 40 feet high was mined, but work was discontinued because of the narrowing of the vein, which might open out again if followed. On level five, which is 55 feet below level four, a drift was run northwest 150 feet and southeast 100 feet. On the northwest, beginning 35 feet from the shaft, 500 tons of ore milled in 1915 showed a reported average value of \$5.25 a ton. This shoot was about 110 feet long according to Rowe. Number six level was drifted northwest 307 feet, of which the first 135 feet were reported in ore that was followed to the next level by a raise. vein continued narrow in the drift for the next 100 feet, then widened into a large low-grade body of quartz. The ninth level is 259 below level six. The intersection of the Pine Log vein with the Mountain King vein is reported on this level and the results of drifting over 200 feet southeast here have been inconclusive so far, due to disturbed conditions on that side of the shaft. On the northwest, the drift passed on hanging wall side of the ore shoot developed above. The northwest drift is about 320 feet long, the last 70 feet being in the large lowgrade quartz body found above. The bottom of the shaft is 245 feet below the ninth level.

The Bulger shaft is 1000 feet northwest of Mountain King shaft and is 110 feet deep. The vein is narrower and higher grade here, and some small dikes were observed, entering from the Mariposa slate on the

footwall.

There is held to be a possibility of encountering the Royal oreshoot by drifting southeast from the present bottom, or by sinking 500 feet in the main shaft, as this shoot was mined to within a short distance of the property line.

The property is equipped with 10-stamp mill, air compressor of 750

cubic feet capacity, shop, and other buildings.

Mowhawk Mine. F. M. Raymond, owner, Altaville. Contains six acres in SE¹/₄ Sec. 31, T. 3 N., R. 13 E., two miles from Angels on Cop-

peropolis road, adjoining Osborne Ranch on the west.

A shaft 110 feet deep, with a crosscut 300 feet long northeastward on 100-foot level, has developed a stringer lead of quartz and schist. A black slate gouge with three feet of broken quartz was struck about 50 feet from the shaft, then 100 feet of black slate or schist, and then a body of hard green twisted schist. High grade ore was found 200 feet from the shaft and was followed upward 35 feet. Four or five tons of this ore yielded \$600 or more. In all, the claim is said to have produced about \$8,000, mostly from a series of shallow holes 20 feet to 50 feet deep. The gold is reported to have been found in large bunches of soft manganese oxide.

There is a 2-stamp mill, with plates and rock breaker, and electric motors, hoist and pump. Last work was done in April, 1924, by Chase

Brothers.

Old Calaveras Group includes Enchantress and Oro Minto Claims, Lots 46 and 47 in Sec. 21, T. 4 N., R. 14 E., six miles north of Murphys. Wm. M. Nuner and estate of John Waters, San Andreas, owners. R. C. Johnson took a lease and option on these claims in January, 1924, and unwatered some of the old workings, but did little except repair

work underground. Idle, March, 1925.

The Oro Minto had a shaft 130 feet deep, and the Enchantress one 110 feet deep, as early as 1872, and had produced a few tons of rich ore. The deeper shaft was subsequently sunk to a depth of 600 feet, and a mill was put up about 1875. The mine is reputed to have had a rather large output, for which definite figures are not available. The vein strikes north of west and dips northeast and averaged two feet wide, increasing sometimes to five feet. It is in the Calaveras formation and carries free gold, pyrite, galena and a little zincblende.

Bibl: State Mineralogist's Report XIV, p. 100; XIII, p. 115.

Red Top Prospect. In the summer of 1924 Red Top Mine, Inc., a Nevada corporation with office in 930 Stock Exchange Building, Los Angeles, made an agreement to purchase two unpatented quartz claims from Joaquin Leonard. The claims are five and a half miles from Douglas Flat via Adams Ranch and are in the northern part of T. 3 N., R. 14 E., at an elevation of 2700 feet.

A shaft was sunk 60 feet on a vein three feet wide striking NW. and dipping 47° SW. The vein is broken on the south face. Drifts were run 30 feet each way and a carload of ore was shipped which was reported good grade. A headframe was being erected and hoist and 10" x 12" compressor were to be installed when work was held up by a lawsuit over the ownership of ground adjoining, in which the company was interested.

F. H. Rindge, 711 Farmers and Merchants Bank Building, Stockton, has been engaged for several years in mining and prospecting operations in the Jesus Maria district. His first work was placer mining on the old Noce Placer Mine on Whiskey Slide Hill, where considerable equipment was installed and hydraulicking was carried on. More recently a prospect shaft has been started and is being sunk with a depth of 1000 feet as the reported objective before much exploratory crosscutting and drifting is done. Surface indications on the vein are stated to be promising, but the shaft, which is now several hundred feet deep is not following the vein at present.

Rindge has consolidated 1243 acres of land in Secs. 11, 12, 13, 14, 23, T. 5 N., R. 12 E., and in Secs. 18, 19, T. 5 N., R. 13 E., and in Secs. 30, 31, T. 6 N., R. 13 E. He is employing 15 to 20 men in his prospect-

ing work.

Royal Consolidated Mines at Hodson have been idle (except for small operations by lessees in the upper levels) for several years. Address Frank Tower, Felix, via Milton, California. Tower plans to resume work underground soon, and surface preparations are now going on (April, 1925) with this end in view.

Bibl: State Mineralogist's Report XIV, p. 103; XIII, p. 117; XI, p. 168. Cal. State Min. Bur. Bull. 18, p. 126.

Sheep Ranch Mine has been the best producer and the deepest developed mine on the East Belt in this county. As an illustration of the geology of this belt, in which no deep mines are open at present, the writer is repeating here an article written after he visited the property in November 1921. At the time of visit, ore going to the mill was reported by the operators to be assaying \$14 a ton, and it was costing \$10 a ton to work it, with a crew of 57 men of whom 38 were working underground. There was always a great deal of trouble caused by high-grading, as the property was characteristically a 'high grade mine.' The concentrate was of little value as a rule. The mine was shut down and machinery removed very shortly after those notes were written, and has been idle since, except for the work of three men who are at present milling some of the dump in a miniature stamp mill. C. L. Feusier, owner, Sheep Ranch.

"The last company, between 1919-1922 unwatered and repaired the workings, sank the shaft to 1700 feet and sank a winze from 1300 to the



Surface plant, Sheep Ranch Mine.

1700-foot level, 750 feet east of the shaft. A sub-level at 1400 feet has been driven 200 feet west and 250 feet east from this winze, the 1550-foot level has been driven 1100 feet east and 300 feet west of shaft, with ore in a series of lenses all the way; and the 1700-foot level has been driven the same distances. At time of visit in November, 1921, stoping from the 1400-foot sub-level had reached the 1300-level, stoping was going on from the 1500-level, and a stope had just been started from the 1700-level, all east of the shaft.

"The vein was generally narrow, but swelled to a width of three feet or more, and occupied a strongly defined fissure which struck N. 55° W. and dipped 70° to 75° NE. in hard, black, siliceous mica schist. Dikes of gabbro or diorite, probably connected with the large gabbro mass to the north, have crossed the vein. The hanging wall showed loose slabs and lenses of graphitic schist, and the tendency of these to fall made careful stoping necessary, for motives of economy as well as safety. A dike appeared on the 1550 and 1700 levels east of shaft.

The vein approached this crossing on the footwall side of the fissure on the 1550-level, narrowed near the dike, and beyond it took the hanging wall side of the fissure.

"The ore was quartz, sometimes bluish in color, and occurred in a series of irregular lenses that sometimes overlapped. It was apt to change suddenly from medium to high grade or vice versa, and this condition increased the difficulties and uncertainties of operation. The continuity and richness of the vein, however, were indicated by the extent of the old workings, in which an average thickness of five feet was stoped for a maximum length of 1400 feet to a depth of 1300 feet, giving a reported yield of \$4,000,000 from 400,000 tons of ore. The pay was principally in free gold. A mixture of various sulphides of iron, copper, lead and zinc, etc., were said to make up only one-half of one per cent of the ore.

"Centrifugal pumps were used on the 850 and 1300-levels, and a Dean Triplex pump on the 1700-level handled about 125 gallons of water a minute to the 1300-foot level. A total of about 200 gallons per minute was pumped to the 300-foot level where it drained off through a

tunnel 2400 feet long.

"The last company started the mill December 24, 1920. Ore was hoisted to the headframe and dumped on grizzlies, where the coarse ore was sorted by two men, then crushed in a 12-inch by 15-inch rock breaker and trammed to the mill bins. Twenty 850-pound stamps dropping 104 times a minute crushed the ore in cyanide solution and discharged at a height of three inches through a coarse punched screen. Pulp from the stamps passed over Hungarian riffles to catch coarse gold and was then classified, the oversize going to a 5-foot by 16-foot tube mill in closed circuit, and ground to about 150 mesh. Entire product was cyanided. It was thickened in a 10-foot by 26-foot Dorr thickener to about 45% solids. Solution from the thickener went to clarifier. thence to gold tank and zinc boxes. Pulp went to three Dorr agitators in series, and thence to four Dorr thickeners in series, which gave a product about 70% solids, and solution passed to clarifiers and to the gold tank and zinc boxes for precipitation. A small part of the solution from the zinc boxes after precipitation of the gold was returned to the agitators to bring the pulp to a consistency of 1:2 but most of it went to No. 4 thickener as a wash. A battery storage tank held 125 tons of solution carrying 0.75 pound of cyanide per ton. About three and one-half pounds of lime and 0.9 pound of cyanide per ton of ore were used."

Bibl: State mineralogist's Report VIII, p. 131; XI, p. 175; XIII, p. 119; XIV, p. 104. Cal. State Min. Bur. Bull. 18, p. 104.

Sherman Ranch (New York-Calaveras or Ranch Mine) is five miles northwest of Hodson. It has been prospected by two shafts between 100 feet and 200 feet deep, and a small amount of drifting. It contains a flat vein five and a half feet wide. Address J. McCarty, Felix, via Milton.

This property has lately been sampled (March, 1925) and there is a possibility that it may be reopened.

Tollgate Mine (Port Arthur claim and Prince property) one-half mile southwest of Altaville on Copperopolis road. A vein strikes N. 65° W. in amphibolite schist. An inclined shaft has been sunk 150 feet with levels at 100 and 150 feet. Forty tons were milled from the 100 level and reported as yielding \$7.50 a ton, half of it in the concentrate. On the 150-foot level about 50 feet of crosscut and drift was run and 21 feet of this crosscut showed very low assays, according to G. A. Ross. Property is idle.

There is a 3-stamp mill, one vanner, hoist and buildings. Last work was done by Tollgate Mining Company.

Triple Lode Gold Mines, Inc., last address, 68 Post St., San Francisco. (Blair Cons.; El Dorado, Jumper Claims.) This company did some work between 1920 and 1923 on the above claims in Sec. 32, T. 3 N., R. 13 E., one and one-half miles southwest of Altaville. The old shaft was 450 feet deep, with levels at 150, 200 and 400 feet, where short drifts were run. New work consisted of a new shaft 250 feet deep, 800 feet north of the old shaft, in the footwall. Levels were turned from this shaft at 150 and 250 feet. On 150-foot level a crosscut was run 300 feet to the 'East Vein' and 60 feet was run on the 'Shaft Vein.' On 250-foot level, they ran a crosscut 300 feet to the East Vein, on which they had drifted 200 feet at the time of last visit, and also drifted 80 feet on a smaller vein. A mill of 20 stamps was brought from the Hardenburg Mine in Amador County but was not erected. There is also a 10" x 12" air compressor, electric power equipment, pump, air hoist, and buildings.

The property was advertised for sheriff's sale February 11, 1924, to satisfy laborers' liens held by Albert Prothero. It had previously been sold at Commissioner's sale, May 19, 1923, to Henry Demaria. The underground workings were not visited as the hoist was not running at the time of visits.

Tullock Mine. Owners: Estate of James Tullock, Mrs. Lillie Bisbee, and Mrs. Emma Sell, Angels Camp. It is in the south part of Sec. 11, T. 2 N., R. 13 E., on Albany Flat, two and one-half miles south of Angels Camp. It is on a branch of the Mother Lode with usual dip and strike and the ore carries more galena than usual for this lode. In 1922 the shaft 800 feet deep was unwatered for examination by Chaparral Hill Operating Company, but no new work was done. In March, 1925, the property was taken under lease and option by J. F. Merritt, who planned to unwater it.

Bibl: State Mineralogist's Report XIV, p. 110; XIII, p. 121; XII, pp. 98 et al. Cal. State Min. Bur. Bull. 18, p. 121.

Washington (Bullion Hill) Mine is in Sec. 20, T. 4 N., R. 14 E., six miles north of Murphy, just west of Sheep Ranch road, and includes one full claim and a fraction. Owner: W. Oslin.

An old adit had previously been driven 1200 feet, following the vein N. 70° E. for 800 feet and giving 200 feet of backs at the face. This vein had been stoped from the adit to the surface for 200 feet in length and the mine had lain idle for years when Bullion Hill Mining Company began work in July, 1921. They operated for two years. The adit was extended 100 feet and lens-shaped orebodies were worked for a length of 135 feet above the adit. The vein is of solid quartz and ribbon rock, three feet to six feet wide, and carries free gold and as high as 10% auriferous pyrite and galena with reported traces of zinc, antimony and manganese. Operations paid for a time, but were

stopped by lawsuits, after the best ore in sight had been mined, and

the property reverted to the owner.

In April, 1924, Fraser and Hibbard of Los Angeles began work and have been running five stamps of the 10-stamp mill intermittently while prospecting for more ore. A winze has been continued to a depth of 100 feet below the adit and drifts had been run 90 feet east and 65 feet west from it at this depth, but good ore had not yet been opened at the end of March, 1925. Lessee with option: Washington Gold Mining Co., Jack Hibbard, president.

Bibl: State Mineralogist's Report XVIII, p. 98; Cal. State Min. Bur. Preliminary Report 8, pp. 25–26.

GOLD MINES (PLACER).

Drift and hydraulic mining have not been very productive in late years in the county, although the unworked gravel deposits are extensive. Most of the new work in this line in the past five years has been on the Central Hill-Vallecito Channel system between Parrot's Ferry and Dogtown. The only producers in the section mentioned have been the Victor Mine (Rainier) near Altaville and the Last Chance Mine at Vallecito. The former is now closed down, and the latter is producing profitably from some sections of rich gravel left by old time miners who worked out most of the good ground. Vallecito Western Mining Company, Inc., under the management of Don Steffa has drilled ground belonging to the Bishop Estate on this channel system on Six-Mile Creek between Angels Camp and Vallecito and has just completed a shaft from which prospect crosscuts and drifts have been started (May 1, 1925) to explore the ground. Calmo Mining and Milling Company under the management of Wm. M. Grafflin has put up substantial works on the Slab Ranch property between the Victor and Vallecito Western, and has sunk a vertical shaft 200 feet deep from which the channel is being prospected. Up to this time, no pay gravel has been extracted.

The gravel in this section has to be mined by shafts as it is below the present drainage, and considerable water has to be pumped.

The Old Stiff Mine near Vallecito is being reopened and early in April the shaft was reported to be opened 142 feet deep.

Elsewhere in the county, mention may be made of a few activities

since the last report.

Chili Gulch Mining Company has brought in electric power and is installing a drag-line scraper on El Encino Gravel Mine, which covers 3000 feet in length along Chili Gulch and a width of 200 feet. It is proposed to work off the tailings which accumulated in the gulch from early day operations. This deposit is a loose, medium-sized white quartz gravel.

Frederick H. Rindge of Stockton did some hydraulic mining at the *Noce Mine* at Whiskey Slide, getting pressure by pumping the water.

He has lately turned his attention to quartz prospecting.

At the *Green Mountain Extension Mine* adjoining the old Green Mountain Mine, a mile and a half south of Mokelumne Hill, an adit is being driven and it is expected will be about 700 feet long when it reaches the channel, during the present summer.

3-39006

The gravel resources of the county have recently been covered in our Bulletin 92 'Gold Placers of California' to which the reader is referred, as well as to other references in the general bibliography accompanying

this report.

Dredging operations were covered in our Bulletin 85, 'Platinum and Allied Metals in California' and in addition to what is noted there, it may be observed that since that bulletin was written, El Oro Dredging Company has finished its ground near Jenny Lind and operations have been continued on the Calaveras River at Jenny Lind by the Isabel Dredge, Ivy L. Borden, owner, and on Mokelumne River, near Camanche and westward by American Dredging Company. The latter companies and Carson Hill Gold Mines (quartz) have been the principal gold producers of the county during the past six years.

Camanche Gold Dredging Company entered the Camanche field late in 1923 with a Risdon dredger carrying 69 buckets of 4-cubic feet capacity each.

IRON.

Some small and unimportant bodies of iron ore have been noted in the county, and are estimated to contain a few thousand tons of ore.

Big Trees (Calaveras) Deposit is in the S¹₂ of Sec. 32, T. 4 N., R. 14 E., a mile and a half north of Murphy and 10 miles from the railroad at Angels Camp. Owners: Domingo Rolleri, of Angels Camp, et al.

Some open cuts and a tunnel 75 feet long were run many years ago to prospect it. It is described as siliceous ore (limonite) on a hill 100 feet high and 300 feet wide, and extending some distance across country, but has not been closely examined.

Bibl: Cal. State Min. Bur. Bull. 38, p. 297. Unpublished field report by C. A. Waring.

Bonanza Deposit is an undeveloped prospect, on the old Bonanza Mine 7 miles southeast of Mokelumne Hill.

The Detert Deposit (Monarch) in Sec. 11, T. 4 N., R. 10 E., a mile and a half north of Valley Spring, is a limonite hill capping. Only assessment work has been done in late years. Assays 55% to 60% metallic iron.

Bibl: State Mineralogist's Report VIII, p. 156; Cal. State Min. Bur. Bull. 38; p. 297; U. S. Geol. Survey Geologic Folio Nos. 3, 5, 11.

There is limonite ore one-half mile north of the Esmeralda quartz mine near Indian Creek, in the Calaveras formation. An assay of this ore showed 56.9% metallic iron.

Bibl: U. S. Geol. Survey Geologic Folios 3, 5, 11.

MOLYBDENITE.

Samples of molybdenite ore occuring in coarse flakes in an acid dike rock have been found in the eastern part of the county near Bloods. This is a rough, mountainous district covered by granite lying at an elevation of 8000 to 10,000 feet and prospectors have failed to find a second time the exact place from which the samples came.

MANGANESE.

A few manganese prospects have been noted in the county. Bulletin 76 mentions prospects of manganese oxide on the Fortner Ranch, 2 miles northeast of San Andreas, and the Manilla Manganese Property, in Sec. 27, T. 4 N., R. 11 E., six miles southeast of Valley Springs. A sample of this indicated it was low grade. Other prospects have been noted, but they are quite a distance from the railroad and have not been developed.

Bibl: Cal. State Min. Bur., Bull. 76, p. 31.

PLATINUM GROUP METALS.

A small recovery of placer platinum has been made from dredging operations along Calaveras River in the Jenny Lind district, and along Mokelumne River in the Camanche district. The producers, some of them no longer in operation, were Calaveras Dredging Company, El Oro Dredging Company, and Ivy L. Borden's Isabel Dredge, in the Jenny Lind district; and American Dredging Company in Camanche district. Production has lately dropped to 20 fine ounces or less annually.

Bibl: Cal. State Min. Bur. Bull. 85, pp. 31 to 33.

STRUCTURAL AND INDUSTRIAL MINERALS.

Calaveras contains large deposits of the industrial and structural minerals and many prospects of less common ones. The remoteness of many deposits from railroad lines, and the rather high freight rates which must be charged on the railroads has retarded exploitation of numerous properties. Nevertheless, more work of this kind is being done in the county each year, as witnessed by the recent opening of a greenstone property at Angels Camp, soapstone and vein quartz deposits at Carson Hill and the proposed erection of a Portland cement plant at Kentucky House. There are numerous undeveloped deposits of chrysotile asbestos, clay and ocher, marble, limestone, miscellaneous stone, roofing slate, white quartz, hard and soft volcanic ash. sandstone and other minerals used in building. A garnet prospect is reported, of good quality but undetermined extent, in the higher and inaccessible mountains on the east side of the county. Small deposits of chromite were mined during the late war. Rock crystal of larger size and better quality than found elsewhere has been produced commercially and opals of possible value are now being tested.

The following notes are intended to give a summary of these different resources. The time allotted for the preparation of the notes and the unusually stormy spring of 1925, prevented as much field work as was desired, but it is believed the subject has been covered in sufficient detail to serve the purpose of a preliminary guide, which will be amplified in a new bulletin on commercial industrial and structural

minerals which the State Mining Bureau plans to prepare.

ASBESTOS.

Chrysotile asbestos of good quality occurs in Secs. 15, 16, 21, T. 21 N., R. 13 E., 7 miles from Copperopolis on the west side of North Fork of Stanislaus River. Efforts have been made since 1904 by Asbestos

Producing Company of California, American Asbestos and Manufacturing Company, American Asbestos Products Company, California Asbestos Company and Pacific Asebestos Corporation to exploit the asbestos, and considerable money has been spent, but there has been no commercial production to date. The extent of development work, and the asbestos prospects revealed by it, were described by the writer in our monthly, MINING IN CALIFORNIA, March, 1922. As stock of this bulletin is nearly exhausted, and as little has been done at the property since it was written, excerpts are given herewith.

"One thousand feet south of the north end of the property No. 3 adit has been driven north in the serpentine about 170 feet. This shows a good prospect of chrysotile asbestos. Between 200 and 300 feet south of this portal is a shaft now open about 30 feet deep on the west side of the asbestos zone, and 300 feet east of it is a cut and tunnel 40 feet long. Both these show good asbestos prospects, Fifteen hundred feet south of these and 250 feet lower on the side of the river canyon, No. 1 adit has been driven about 250 feet; it is in harder serpentine which does not carry asbestos in the same amount as in the upper workings, although the fiber is in evidence on the surface between the workings. No. 2 adit is 80 feet long and a little above No. 1.

"The upper workings mentioned above indicate a promising asbestos-bearing area about 500 feet long and 300 feet wide. The company's engineer, W. J. Woolsey, claims that they have an area 2500 feet long north and south by 1000 feet east and west which is indicated to carry enough asbestos to pay a profit, but this was not all covered by the writer. Mill runs made some years ago are said to have shown about five per cent fiber in rock taken from No. 3 adit. The fiber ranges up to one inch in length and appears to be of good quality.

"Improvements and equipment include a concrete-covered camp building, ammonia refrigeration plant, 3-drill air compressor, three air drills, 2500 feet of air pipe line, blacksmith shop, four ore cars, 600 feet of track, electric motors of a total of 200 horse power, three miles of 17,000-volt electric line and some asbestos milling and screening machinery from a small mill formerly used experimentally. The company hopes to have a new mill in operation during the present summer, but have not yet begun construction. The property is seven miles from Copperofolis and about the same distance from the railroad at Chinese, which could be reached by bridging the river and repairing an old stage road."

An assessment of \$10 a share was levied October 4, 1924, upon the stock of Pacific Asbestos Corporation, which is the last of these companies to work on the property. Ownership of the 610 acres in the project has been divided among several persons and corporations, from whom the last-named company has been holding the land partly under option, and partly under mortgage. On January 26, 1925, California Asbestos Company obtained judgment and decree of foreclosure against J. A. Voorhees, Lillian M. Voorhees, American Asbestos Products Company and Pacific Asbestos Corporation and 160 acres of the holdings were sold February 27, 1925, to Newton Todd of Long Beach. The land sold is NE¹ of SE¹ Sec. 16; NW¹ of SE¹ and SW¹ of NE¹ Sec. 16; and S¹/₂ of SW¹/₄ of NW¹/₄ and W¹/₂ of NW¹/₄ of SW¹/₄ Sec. 15, all in T. 1 N., R. 13 E., M. D. B. & M., known as Asbestos & Reynolds Ferry Placer Mines. Pacific Asbestos Corporation has an office at 1798 Broadway, San Francisco.

Turner & Lloyd prospect is about three-fourths mile southeast of the old Nassau copper mine and one-fourth mile from the Copperopolis-Angels Camp road at a distance of nine miles from Angels Camp, the nearest railroad station, or 15 miles from Milton. There are 80 acres on which good prospects of short-fiber chrysotile asbestos have been found in a number of places, but only assessment work has been done. An old road connects the prospect with the main road. Dr. H. C. Turner and Jarvis Lloyd of San Andreas are the owners.

BARITE.

Barite often occurs as a gangue mineral in the copper mines of the state and was so found at the Napoleon Copper Mine, the Satellite

Copper Mine and no doubt others. Some unsuccessful experiments were made upon samples from the Napoleon Mine in an effort to produce barite of sufficient purity for commercial use.

CEMENT.

The probability of the founding of an important new industry which will mean a great deal for the county is indicated in preliminary work and property transfers already completed. William MacNider has been working for two years or more on plans for the financing and establishment of a cement plant at Kentucky House to utilize limestone deposits there and elsewhere in the county. These plans include a branch railroad from Valley Spring for which the original survey had to be changed on account of Stockton flood control project on Calaveras River. A second survey for the railroad has just been completed (May 1, 1925). Preliminary drilling and tests of the Kentucky House deposits have been about finished, and plans for the plant are now being considered.

Late in March, 1925, Wm. MacNider, Chas. P. Snyder, Geo. B. Poore, Lloyd Baldwin and Robt. Duncan deeded to Calaveras Cement Company, several options and contracts, and parcels of land containing limestone deposits in the vicinities of Kentucky House, Cave City and on O'Neill Creek. William Wallace Means and other easterners are reported to be interested in the new company, which has a staff at

San Andreas in connection with the work.

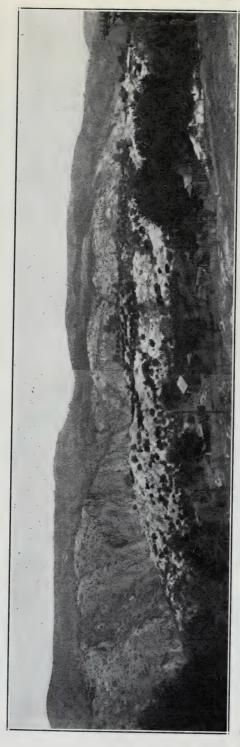
CHROMITE.

During the World War, 12 or more properties in this county produced chromite, but none of them were very large producers and they have all been idle since 1918. For details regarding properties, the reader should refer to Bulletin No. 76, 'Manganese and Chromium in California,' pp. 121–123, 216–217. The chromite resources of this county are not of as much importance as in other counties, the total recorded production having been about 8000 tons, of which practically all was produced between 1915 and 1918.

The following properties are of record in Bulletin 76:

SYNOPSIS OF CHROMITE PROPERTIES.

Name of property	Owner or operator	Post-office address of owner or operator	Section, town- ship and range	Length of haul, railroad shipping point
Burnham Ranch Campbell Clary and Langford Davis Dean Hinch Lowry Mc Faul Peri True Blue Vogelgesang Ward	Burnham Bros. Mineral Res. Corp. Nassau Copper Mining Company Jno. Davis. S. P. Dean Federal Ore Company Hinch Geo. C. Lowry J. McFaul. F. Peri Mrs. E. S. Madrid. D. D. Vogelsang Geo. Ward	Copperopolis Angels Camp Copperopolis Felix San Francisco Angels Camp Fosteria Angels Camp Copperopolis Angels Camp Valley Spring Fosteria Fosteria	1-13 1-13 10-2-12 14-2-12 14-2-12 3-2-12 23-5-10 6-1-13	16 miles, Milton. 16 miles, Milton. 8 miles, Angels. 15 miles, Milton. Milton. 7 miles, Angels Camp. 4 miles, Valley Spring. Milton. 10 miles, Angels Camp. 5 miles, Valley Spring. Valley Spring.



Limestone Cliff on Stanislaus River, Calaveras and Tuolumne counties. The cliffs in the background are on the Calaveras County side.

Looking northwest from Columbia Marble Quarry,

CLAY.

Preliminary Report No. 7, pp. 43-44 mentions:

W. A. Houts, 202 Balboa Bldg., S. F., deposit at Burson.

Penn Mining Co. A. P. Busey, manager. Deposit at Campo Seco; clay beds overlie copper ore. Used in copper smelter.

Valley Spring Clay Pit, one-fourth mile northwest of Valley Spring station. Pottery clay (variegated, red burning) is worked and shipped to California Pottery Company at San Francisco. Operation of this pit continues, and the company has added considerable equipment. The property is served by a spur track from the Southern Pacific branch line.

The Ione formation, carrying white and light-colored siliceous clay, traverses the county from Camanche southward past Milton. This series of beds is being extensively worked in Amador County, and should the demand for this type of clay warrant, no doubt that part of the Ione beds adjacent to the Valley Spring railroad branch could

supply it.

The Valley Spring district and adjoining country from Mokelumne River to Milton is an area in which may be found a variety of clays, volcanic tuffs and mixtures of the two with some beds of the tuffs showing the sorting action of water probably due to their transportation by slowly-moving streams, or stratification in shore waters. Some of the beds show the character of clay of the 'rock soap' type, as indicated in a sample taken on the Field Ranch, five miles from Valley Spring on the Fosteria road. The outcrop there is small, and probably not of commercial grade. Parts of this area adjacent to Mokelumne River east of Lancha Plana will be affected by the water supply project of the East Bay Utilities District, which is said to have already purchased land there.

LIMESTONE.

The limestone resources of Calaveras County are extensive but undeveloped. Deposits occur in a belt of Calaveras (Carboniferous) formations with strike northwest passing a mile west of San Andreas; and the largest limestone bodies in this belt are at and south of Kentucky House, from two to four miles south of San Andreas. Another large deposit, which has been mapped as having a length of two and a half miles in a northwesterly direction, passes through Cave City. More immense than these, however, and rivalling if not exceeding in size any other limestone deposits in the state, is the area of limestone and marble extending from Sonora in Tuolumne County to a point three miles northwest of Murphys in Calaveras County. The North Fork of Stanislaus River has cut a canyon 1000 feet deep through this limestone and traverses it for a distance of three and one-fourth miles. Much of the limestone in the county has been changed to marble due to the pressure and folding exerted upon the rocks of the Calaveras formation, which everywhere show schistose structure.

There is no limestone production now in the county except the small amount used at the smelter of Calaveras Copper Company at Copper-opolis. An important development is promised in this line by the projected erection of a Portland cement plant near Kentucky House.

(See Cement.)

MARBLE.

As mentioned above, much of the limestone in the county has been altered to marble. The large body extending from Tuolumne County (where it is quarried at the Columbia and Bell Marble Quarries) covers extensive areas near Murphy, Vallecito and Douglas Flat. Several attempts have been made to open quarries, among which may be noted the Angels Marble Quarry where the California-American Marble Company installed equipment and made a few shipments; and the Eagle Marble Quarry, a mile east of Vallecito, where the Eagle Marble Company made a small production, and later Eagle Marble and Lime Company proposed to operate, but have done little, although still alive as a company. None of the other deposits mentioned under limestone have been worked because of their distance from railroads.

The deposit near Vallecito and Murphy contains two very interesting caves known as the Moaning Cave and Mercers Cave, which are visited

by many sightseers.

MINERAL PAINT.

On the *Holmes Ranch*, at Campo Seco, there is a body of decomposed slate, stained by iron oxide, which has proved to produce a durable paint.

Bibl: State Mineralogist's Report XIV, p. 130.

Late Ocher Mine, one-half mile west of Valley Spring, produced several carloads of ocher 25 to 30 years ago, but has been idle lately. The ocher varied in color from yellow to dark red.

Bibl: Cal. State Min. Bur. Bull. 38, p. 338.

D. F. Rhoden of Valley Spring reported to this Bureau an ocher deposit three miles from that place. Samples of brown and yellow ocher were submitted, but the deposit has not been visited so its extent and character are not known to the Bureau.

In this connection, refer also to Iron, deposits of which mentioned

herein, may be suitable for paint in some cases.

MINERAL WATER.

Mok-Hill Mineral Springs. Zumwalt, Dahl, and Zumwalt of Mokelumne Hill continue the operation of a small bottling plant at that place. The water of this spring, which has been well known since the early days, is bottled and lightly carbonated. The water carries magnesium especially, and calcium and sodium to a less extent. It is remarkably clear, standing for years without murkiness.

Bibl: State Mineralogist's Report XIV, p. 130.

Valley Spring Mineral Well. This well is near Valley Spring and is 150 feet deep. The water is rich in chlorides and carbonates.

Bibl: State Mineralogist's Report XIV, p. 130.

MISCELLANEOUS STONE.

Angels Greenstone Company. (Formerly Pacific Rock Granule Co.) Main office 201 Nevin Avenue, Richmond. C. S. Renwick, manager. Plant at Tryon Mine, adjoining Angels Camp.

Green amphibolite schist, locally called greenstone, is mined from the 200-foot level of the Tryon Mine and hoisted. The primary crusher reduces it to one and one-fourth inch size, and it is screened and most of the dust removed, after which the rock passes through a system of rolls and screens, and the rest of the dust is removed by air suction.

The products are stucco dash, passing 3-mesh and retained on 4-mesh; roofing rock, passing one-half inch; retained on 4-mesh; roofing granules, running about 25% of 14-mesh, 50% of 20-mesh and 25% of 40-mesh. A large part of the final product is too fine for the above uses, and the finding of a market for it is a problem. A screen analysis of this product or dust, made at the time of the writer's visit, follows:

pieces)

A chemical analysis of amphibolite schist from California by Hillebrand¹ shows:

SiO ₂	45.56%	
Al ₂ O ₃	14.15%	
FeO	9.83%	
Fe ₂ O ₃	1.20%	
FeS ₂	7.86%	
MgO	6.76%	(probably present as MgCO ₃)
CaO	2.30%	(probably present as CaCO ₃)
K ₂ O	1.18%	
Na ₂ O	1.57%	
CO ₂	3.04%	
TiO ₂	1.11%	
H ₂ O (above 100° C)	4.84%	

Traces Cu,S, MnO, BaO, PO, SO,

This probably represents very closly the composition of the product

Anyone in a position to utilize such a finely ground product could probably get an advantageous price. A freight rate of less than \$3 a ton to San Francisco could be had.

This plant employes four men and has ample capacity to fill orders.

Hesperides Mining Co. plant and office were at Wallace, Calaveras

County. H. L. Patterson, secretary.

The company erected a large plant at Wallace as mentioned in our MINING IN CALIFORNIA for January, 1924, p. 7. They produce quite a large amount of crushed rock, gravel and sand. An ancient gravel deposit containing a little gold, was worked. The crushed rock and sand were used in large quantity for concrete highway construction during 1924, but when they began taking material from a second section of the deposit the rock was found to be too soft and rotten for use in concrete. The plant shut down in the latter part of 1924 and was being junked in March, 1925. It was said to have cost close to \$200,000. It was laid out in such a way that there was no storage provision between the steam shovel and crusher and the entire plant had to be operated as a unit. Little gold was recovered.

¹ U. S. Geol. Survey, 14th Report Vol. 4, Pt. 2, p. 259.

OPALS.

Opals were found in the early days in some of the old drift mines at Mokelumne Hill, and caused considerable excitement until it was

determined that they were not of gem quality.

More recently Robert Irvine of Mokelumne Hill has found a deposit of opals occurring near the surface in a pink clay seam enclosed in andesite tuff and breccia. The stones are each enclosed in a shell of pure white silica, evidently the result of alteration of the opal itself, and many of them are of good size. Promising results have been had during the past month by a jewelry firm that has cut some of these opals and further tests may reveal stones with sufficient play of colors to be classed as gems.

It is possible that these opals may be distributed more widely than heretofore realized, as the writer has noted the occurrence of similar pink seams in the andesite tuff nearly a mile from the above deposit and several hundred feet lower. This andesite flow covers Stockton Hill, a long ridge running westward from Mokelumne Hill, and underlain by an ancient river channel which was mined extensively in years

past.

QUARTZ.

White vein quartz for industrial uses has been produced during 1924 from the Iron Rock Mine at Carson Hill. Jim Oneto has lately been mining the quartz on contract, and shipping it out over the Sierra Railway of California whose tracks adjoin.

There are numerous other white quartz veins in the county, among which those in the Carson Hill district are nearest to railway transportation. This mineral commands such a low price that it can be profitably mined and shipped only when quite near the railroad.

ROCK CRYSTAL.

Green Mountain Mine is a mile and a half south of Mokelumne Hill in Chili Gulch. It has produced probably the largest quartz crystals ever found. J. J. McSorley who has been in charge of the property for many years, states the crystals were found loose in a sand bed on a bar of the buried river channel while working it as a drift mine. This was one of the earlier channels, filled mostly with quartz cobbles and quartz sand. McSorley states the largest rock crystal found weighed over a ton, and there were many large crystals containing a great deal of clear unshattered quartz, indicating the crystals had not traveled far from their source. The 'root' end of a crystal is generally milky, or translucent. If these crystals formed in an open fissure or vein, as many suppose, this has not yet been proved here, as no such vein has been encountered in the workings. Between 1897 and the close of the late war, 22 tons of crystals were mined and sold. One carload of boxed crystals was shipped to New York, and for many years the market was supplied from this lot by Tiffany and Company.

Rock crystal in large sizes without flaws is rare, and those from this property have been used in cutting the largest perfect spheres ever made from quartz, and in making large lenses and prisms for telescopes and spectroscopes, lenses for cameras, interferometers and other optical

¹ Mr. Blay of Mokelumne Hill, who helped prepare the largest crystal for shipment, states it was about six feet long and weighed 2800 pounds.

instruments. McSorley states a sphere 14 inches in diameter was cut from one of these crystals, and Kunz¹ mentions two spheres $7\frac{1}{5}$ inches in diameter, which were not entirely flawless, and one perfect sphere $5\frac{1}{2}$ inches in diameter, cut from these crystals. Rock crystal permits the passage of many of the light rays of short wave-length, to which a glass lens is opaque, and is utilized where it is desired to use or study ultra-violet and similar rays. Quartz spheres are also much sought after by 'crystal gazers' and the crystals are in demand for jewelry and bric-a-brac.

The old tunnel from which the crystals were produced is caved and inaccessible. On the adjoining *Green Mountain Extension* claim, on the same channel, McSorley is now driving a new adit to develop an unworked section of the gravel deposit, where he hopes also to find more crystals. This adit will be 700 feet long and will be completed this summer.

Miners acquainted with former drift mining operations near Mokelumne Hill state that a great many quartz crystals were thrown away during the operation of mines now worked out and deserted. These crystals were spoiled and lost by going over the dumps.

SLATE.

Two extensive belts of Mariposa (Jurassic) black slate traverse the county, and contain material of grades suitable for roofing and other purposes. The westerly belt passes through Salt Spring Valley and northwestward to Valley Spring. Some work has been done on this slate about 10 miles east of Milton, but this was years ago. The other slate belt passes west of Carson Hill and Angels Camp, in a northwesterly direction.

California slate, in common with other natural building stones, has suffered from the competition of artificial products, and this competition has been especially severe in the case of roofing slate, as there are so many substitutes which are aggressively advertised by their makers. Due to distance from main-line railroads, the slate of Calaveras County would be handicapped in competition with that from other counties.

SANDSTONE.

Two small sandstone quarries were opened years ago, one on the Late Ranch, a mile south of Valley Spring, where some white sandstone was quarried; the other on the Wildermuth property, three miles northeast of Valley Spring, where a soft gray stone was worked. These quarries, in common with most others in the state, have been idle in later years because of the competition of cement.

SOAPSTONE AND TALC.

A sample lot of several tons of soapstone was shipped in April, 1925,

from the John Peirano property near Carson Hill.

There are other deposits of soapstone and talc of good grade in the county, notably on the Aime Laidet property, six miles east of Mokel-umne Hill, where a bed of good grade talc three feet wide is accompanied by a wide body of soapstone. This is difficult of access and too

¹ Kunz, G. F., Gems and jewelers' materials of California: Cal. State Min. Bur. Bull. 37, pp. 65-66, 1905.

far from present railroads to be exploited. Other deposits have been noted two and a half miles west of Murphys, where some production was used locally, and a mile southwest of Vallecito, where there in an off-color deposit of soapstone and tale. Distance from railroad and the relatively high freight rates that necessarily prevail on the short-line railroads serving this district, have held back the development of such commercial minerals, which at present are being mined and shipped from deposits elsewhere that are more advantageously situated.



SAN FRANCISCO FIELD DIVISION.

C. McK. LAIZURE, Mining Engineer.

MERCED COUNTY.

Introduction.

Merced County was created on April 19, 1855, from the western portion of Mariposa County. Originally its western boundary extended from the present northwest corner of the county southeasterly along the crest of the Coast Range almost to the Sixth Standard Parallel South, the southern boundary of Kings County, and its original area was close to three times its present area. The following year Merced County was reduced to approximately its present size by the organization of Fresno County on the south, the dividing line being practically the same as it is today.

Geography and Geology.

The county is situated near the geographical center of the state. It is bounded on the north by Stanislaus County, on the east by Mariposa, on the south by Madera and Fresno, and on the west by Santa Clara and San Benito counties. It has an area of 1995 square miles and supports a population of 24,579 (1920 census). Most of the land is cultivated, and much of it is irrigated, there being extensive irrigation systems covering the valley lands.

Merced is essentially an agricultural county, yet it stood thirty-eighth among the 58 counties of the state in the value of its mineral production in 1923, ranking ahead of Sonoma, Monterey, El Dorado, Siskiyou, Mariposa, San Luis Obispo, Mendocino, Mono, and a dozen others.

The greater part of the county lies within the San Joaquin Valley, and is composed of unconsolidated sands, gravels, and clays of Quaternary age. Along the eastern edge of the county there is a narrow belt of Tertiary formations, represented mainly by clays, shale, and massive sandstone. On the western side of the county Cretaceous sandstones and shales appear, and as the western boundary of the county, near the summit of the Coast Range, is approached Franciscan rocks of Jurassic age are exclusively in evidence. These consist mainly of slates, cherts, sandstones, schists, and serpentine,

Mineral Resources.

Both metallic and non-metallic minerals have been found and produced in Merced County. Among the former are gold, platinum, silver, copper, and a few pounds of lead. Crushed rock, gravel, sand, clay, and clay products are the chief non-metallics. In addition to these the occurrence of a few other minerals has been noted, such as cinnabar (quicksilver), stibnite (antimony), barite, calcite, diatomaceous earth. magnesite, asbestos, manganese, coal, and soda niter, but for the most part these are entirely undeveloped and probably most of them do not occur in marketable quantities.

Gold dredging operations on the Merced River in the vicinity of Snelling, which ceased in 1919, account for the major portion of gold. platinum and silver produced. The small output of copper years ago all came from one locality, the extreme southwest corner of the county

in Township 13 S., Range 9 E.

Miscellaneous stone, including crushed rock, gravel, and sand, and brick and tile, are at the present time the principal mineral products. The establishment of a cement plant at Merced is under way, and cement will no doubt be added to the list within the near future. Structural materials of this nature will contribute almost exclusively to the future mineral output of the county.

The following table gives the total recorded mineral output of the

county from 1880 to 1923, inclusive:

MERCED COUNTY, 1880-1923.

Year Gold,			Miscel- laneous	Brick		Misce	ellaneous and	d unapportioned	
value	stone, value		M.	Value	Amount	Value	Substance		
1880	\$17,515					*******			
1881	1,500								
1882	10,000								
1883	10,000								
1884	6,500								
1885 1886	10,000 7,000								
1887	10,767	\$5							
1888	10,000	90							
1889	4.843								
1890	2,000	59							
1891	1,728	17							
1892	445								
1893									
1894	763								
1895	1,500								
1896	1,250								
1897									
1898 1899									
1900	(1)								
1901	(1) (1)					79,071 lbs.	\$12,453	Copper.	
1902	(-)					14.400 lbs.	1.656	Copper.	
1903	(1)					6,000 lbs.	780	Copper.	
1904	(1)					8,900 lbs.	1,135	Copper.	
1905	(1)			600	\$3,500				
1906				650	6,000				
1907	822	10		1,250	12,500			v 1 1	
1908	2182,970	21,196		700	6,300		106	Lead and copper.	
1909	²228,492	2572		700	6,300		18,264	Unapportioned.	
1910	(1)	(1) (1)	\$64,764	700	6,300				
1911 1912	(1)	(1)	49,548 45,000						
1912	42,255	492	30,000			19,240 lbs.	2,982	Copper.	
1915	²111,361	2340	30,000			10,210 108.	2,002	oppor.	
						690 lbs.	32	Lead.	
1915	(3)	(3)					94.000	Other minerals.	
1010	(2)	(2)				90 tons	720	Magnesite.	
1916	(3)	(3)					80,810	Gold, platinum, silver	
1917	(3)	(3)	70,500				76,616	Gold, platinum, silver	
1918	41,089	254	32,500				1,006	Other minerals.	
1919	(1)	(1)	40,350						
1920	0.100		24,800						
1921	3,163	87	30,300				69,469	Building tile, gold and	
1922	(3)	(3)	88,110				09,409	silver.	
1923	(3)	(3)	134,063	(3)	(3)		101,567	Brick, building tile gold and silver.	
Totals	3\$665,963	*\$2,632	\$609,935	4,600	\$40,900		\$461,596		

¹Included with Stanislaus County production.

In compiling the following data on the mineral resources of Merced County, an endeavor has been made to mention all those that have come to the attention of the State Mining Bureau, whether commercial or not. Only those properties at which there has been some recent

²Includes Stanislaus County production. ³See under 'Unapportioned.'

Dredge output included under Stanislaus County.

development or production are described in detail; such notes as have been published concerning the other deposits will be found by referring to the bibliography.

ANTIMONY.

Fine specimens of stibnite, the common ore of antimony, have come from the McLeod mining district, which was organized in 1872. It embraces the summit of the Mount Diablo Range and covers portions of Merced, San Benito, and Santa Clara counties, in Townships 11 and 12 S., Range 7 E. Antimony Peak in Sec. 32, T. 11 S., R. 7 E., is characterized by its many veins of antimony. Most of the early production, however, came from mines located on the San Benito County side of the line. There has been no recent activity, but the district holds out possibilities, should the price of the metal increase enough to justify mining.

Bibl: State Mineralogist's Reports VIII, p. 485; X, pp. 515-517; XII, pp. 22-23. State Min. Bur. Bull. 91, p. 29.

ASBESTOS.

Asbestos is said to occur in Townships 7 and 8 S., Range 16 E., near the Mariposa County line. The deposits are undeveloped and of doubtful value.

Bibl: State Mineralogist's Report XIV, p. 179.

BARITE.

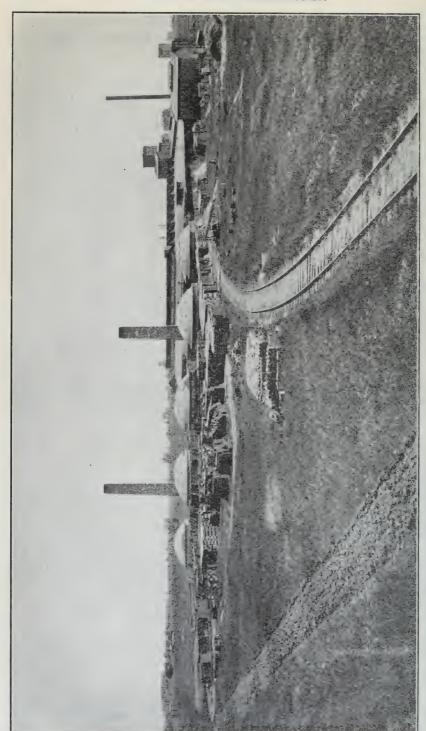
Barite, mixed with triboluminescent sphalerite, has been found in the vicinity of Merced Falls. The occurrence is of mineralogical interest only.

Bibl: State Mining Bur. Bull. 91, p. 263.

BRICK AND TILE.

The California Pottery Co. F. A. Costallo, president; P. G. Lingren, secretary; home office, Merced, California; M. C. Alsip, plant superintendent. This company has a large plant at Creegan Siding, two miles south of Merced, and is producing hollow building tile, roofing tile and face brick. The plant was erected in 1921, and production began in January, 1922. Fire clay is procured at Valley Springs, Calaveras County, and some buff-burning clays from Lincoln, Placer County. About 40% of the clay used is shipped in, and 60% is dug at the plant on the company's property, which contains 53 acres. The local clay is a somewhat sandy loam, occurring under the hardpan strata. It is dug and conveyed to the plant with Fresno scrapers.

A Stevens and Raymond dry pan does the grinding, the stiff mud process being used. A No. 290 American Clay Company machine is used for making brick and hollow tile, and a No. 233 machine of the same make for the roofing tile; both being of the auger type. From the machines the green brick and tile pass to a traveling belt. They are taken from the belt, stacked on cars and then run to the dryer. This is a 20-track American Clay Company dryer, using waste heat from the kilns. Drying takes about 36 hours.



Plant of The California Pottery Company, Merced, California. Photo by courtesy of the company.

There is a battery of eight Beehive kilns, down-draft type, each of 30 feet inside diameter. Crude oil of 14° gravity, atomized by steam, is used for fuel. The burn takes about 98 hours, and the finish temperature approximates 2100° F. (cone .01). A department to make hand-molded products is contemplated. A Southern Pacific spur track runs to the plant, and most shipments are in car lots. Electric power, furnished by the San Joaquin Light and Power Company, is used throughout, 290 horsepower being required. The capacity of the plant is 50 tons per day, and 35 men are employed.

CALCITE.

The mineral calcite, said to be strontium-bearing, is reported to occur at Delhi, but there are no limestone (calcite) deposits of commercial value known within the county.

Bibl: State Mining Bur. Bull. 91, p. 128.

CEMENT.

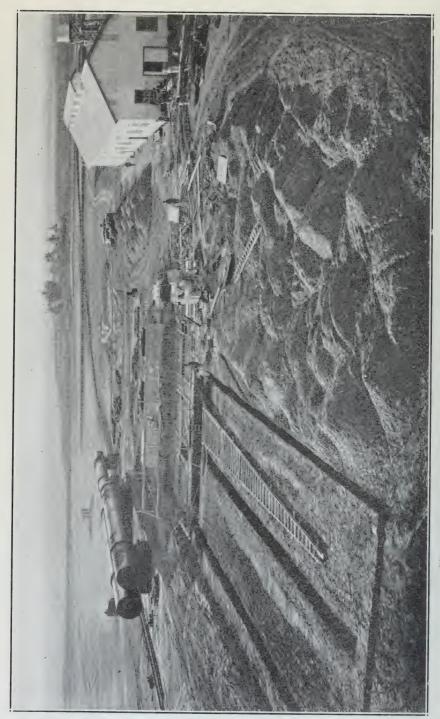
Yosemite Portland Cement Corporation. A. Emory Wishon, president; W. A. Sutherland, vice president; Murray Bourne, secretarytreasurer. This company owns a plant site of 145 acres located about two miles north of Merced, upon which they have a cement plant of 2000-barrel initial capacity, about one-third completed. The plant has direct connections with the Southern Pacific and Yosemite Valley railroads, and the Santa Fe is preparing to build a spur track to the mill. The plans call for a mill of reinforced concrete and steel construction, using what is known as the 'straight-line wet process.' It will contain three kilns, already on the ground, 160' long and 8' in diameter. The finished cement is to be stored in six reinforced concrete 'silos,' each 30' in diameter and 90' high, having a capacity of 90,000 barrels. Electric power, furnished by the San Joaquin Light and Power Corporation, will be used throughout. Water will be obtained from deep wells on the plant site and from the Merced River at the quarry site at Jenkins Hill, Mariposa County. The corporation has acquired approximately 1000 acres at the latter point containing immense deposits of high-grade limestone adjacent to the Yosemite Valley Railroad. The limestone deposits are in Secs. 7 and 8, T. 3 N., R. 19 E., at an elevation of 1340 feet at the railroad. Large open-face quarrying operations will be possible, with steam-shovel loading and spur-track transportation to the quarry crusher plant. An innovation in the crushing department is the plan to reduce the rock from quarry size to about \(\frac{3}{4}\) inch in one operation, using a giant Williams mill of special design for the work. The distance from the quarries to the mill is approximately 63 miles. The other principal raw material required is clay. This will be mined at the mill site where extensive deposits of suitable clay have been developed.

When the Yosemite Portland Cement Corporation's plant is com-

pleted there will be a total of eleven cement mills in California.

CLAY

No deposits of high-grade white-burning clays are known, and up to the present only small amounts of low-grade clay have been utilized.



Site of cement plant of Yosemite Portland Cement Corporation, Merced, California, Photo by courtesy of the company.

Clay that can be used in the manufacture of common brick is found in the vicinity of Merced. During the period from 1905 to 1910 the Merced Brickyards produced a considerable quantity of brick, but it has not been operated since that time.

M. Goldman, of Merced, is the owner of large land holdings in the eastern part of the county, and it has been reported in the past that white clay, suitable for the manufacture of pottery, occurs on this property in the vicinity of Merced Falls. The holdings have not been thoroughly prospected, but the investigations that were made failed in finding any high-grade clay; the material being apparently a silt deposit of indefinite composition, rather than a residual clay.

Clay deposits are mentioned also as occurring in T. 5 S., R. 14 E.

Their character and value have not been determined.

A somewhat sandy loam, obtained on the property of *The California Pottery Company*, is used to the extent of 60% of the plant's requirements in the manufacture of roofing tile, building tile and brick.

The Yosemite Portland Cement Corporation plans to utilize the local clay found on its 145-acre plant site two miles north of Merced in the manufacture of cement.

It seems certain that the better grades of clay do not occur in abundance within the county, but low-grade clays are found and being used, and these probably occur in quantity sufficient for all local needs.

Bibl: State Mineralogist's Report XIV, p. 605; Preliminary Report No. 7, p. 64.

COAL.

Indications of coal have been found at a few points in the county; notably three miles northwest of Snelling, where in 1893 it was reported that a 3' vein of lignite, similar to that at Ione, had been cut in boring a well. Other indications have been found south of Merced River, between it and Bear Creek, but nothing of commercial importance has so far been developed.

Bibl: State Mineralogist's Reports X, p. 331; XII, p. 58; XVII, p. 149.

COPPER.

Two copper properties have been described by name in early reports of the State Mining Bureau. The *Jose Copper Claim* was located in Sec. 4, T. 14 S., R. 9 E. Considerable development work was done here and some small bodies of chalcopyrite ore carrying good values in gold and silver were exposed.

The Victor Bonanza Group was located in Secs. 30 and 31, T. 13 S., R. 10 E., and in Secs. 14, 15, 16, 23, 24, and 25, T. 13 S., R. 9 E., 16 miles southwest of Dos Palos. A mineralized belt is found here extending for five or six miles and having a width of from 100 to 200 feet. Native copper and chalcopyrite occur in the croppings. Only a little development work has been done. The county is credited with a small production of copper during the years 1901, 1902, 1903, and 1904. There was an output of about 20,000 pounds again in 1913, the last year in which any activity was noted in the district.

In 1920 it was reported that Mr. George Berg, of Panoche, had discovered a deposit of copper ore assaying high in gold and silver, about



Portion of limestone deposit at Jenkins Hill, Mariposa County, owned by Yosemite Portland Cement Corporation, Merced, California.

Photo by courtesy of the company.

18 miles east of Chowchilla. Development work was started in May of that year, but the result of this work was not learned.

Bibl: State Mining Bur. Bull. No. 50, pp. 171–172. State Mineralogist's Reports XIV, p. 605; XVII, p. 149.

DIATOMACEOUS EARTH.

Extensive undeveloped deposits of diatomaceous earth are found in the hills bordering the west side of the valley from Ortigalita Creek southerly for six or eight miles.

The beds in this locality appear to be of excellent quality and they

will doubtless be utilized at some future time.

Bibl: U. S. Geol. Survey Bull. 603, p. 211.

GOLD, SIVER AND PLATINUM.

Of the precious metals named above, gold has been produced in greater or less quantity for many years, and there is still a small annual yield.

The sands and gravels of nearly all the streams entering the county on its eastern side carry some gold. Production has come entirely from placer operations. The most important of these has been the gold dredging operations of the Yosemite Gold Dredging and Mining Company, formerly carried on at Snelling, on the Merced River. Silver and platinum have been a by-product. Since the discontinuance of dredging in 1919, the output has become almost negligible, now coming entirely from a few small individual operations carried on intermittently.

Bibl: State Mining Bur. Bull. 57; Bull. 85.

MAGNESITE.

Magnesite occurs near the line between Merced and Stanislaus counties in Sec. 32, T. 8 S., R. 7 E., and some shipments have been made by rail from Ingomar. This material originated, however, on the Stanislaus County side.

MANGANESE.

Briggs Mine. Mrs. Anna E. Briggs, Hollister, California, owner. This property is in the S½ of the NW¼ of Sec. 13, T. 13 S., R. 9 E., in the extreme southwestern corner of the county. It is 26 miles by road east of Tres Pinos, San Benito County, or it can be reached via Los Banos. The manganese outcrop is near the top of the ridge at an elevation of 3550'. An open cut has exposed a face of high-grade ore 3' to 4' wide. From indications, it appears that a good deposit might be opened up here, but in common with many other California occurrences, under normal conditions, its commercial value is doubtful. Should an emergency again occur, such as that during the world war, when high prices prevailed and specifications for commercial ore were lowered, this mine would undoubtedly become a producing property.

Bibl: State Mining Bur. Bull. 76, pp. 49-50; Bull. 91, p. 124.

PETROLEUM.

Petroleum, or mineral oil, is one of California's exceedingly valuable mineral resources. Large well-defined productive oil fields have been developed, mostly in the southern counties, and development work is constantly being caried on in an endeavor to discover new productive areas. The presence of favorable formations, seepages and other indications has been noted in a number of the central and northern counties, and drilling has been undertaken in many of them.

Merced County has not been overlooked in the wide search for petroleum. The prospecting for and production of this mineral product differs so radically, however, from other forms of mining that the oil industry is usually considered as a distinct and independent branch. For this reason no effort was made to include it in this report. All development operations are reported in current issues of 'Summary of Operations, California Oil Fields,' issued monthly by the Department of Petroleum and Gas of the State Mining Bureau.

Bibl: State Mining Bur. Bull. 89; U. S. Geol. Survey Bull. 603.

QUICKSILVER.

Cinnabar occurs in small amounts on the dividing line between Merced and San Benito counties, in the Stayton district. There has never been any production credited to Merced County.

Bibl: State Mining Bur. Bull. 78, p. 72; Bull. 91, p. 44.

SODA NITER.

The occurrence of soda niter (chili saltpeter) is of mineralogical interest only, as no important deposits are found in the state. The mineral has been identified in crusts with other sodium salts from Merced Bottom.

Bibl: State Mining Bur. Bull. 91, p. 245.

STONE INDUSTRY.

(Crushed rock, sand and gravel.)

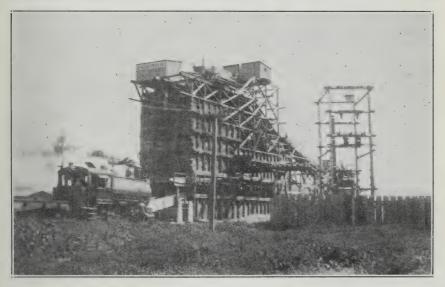
Bent Bros., Inc. Arthur S. Bent, president; Wilbur Atkinson, secretary; home office, 418 South Pecan Street, Los Angeles. This company has a contract on the Exchequer dam, under construction on the Merced River above Merced Falls, and is operating a crushed rock, gravel and sand plant at a point locally called Bent's Pit on the Yosemite Valley Railroad five miles from Snelling and 13 miles east of Merced. The plant was started December 1, 1924. The deposit. which is on the Merced River, is owned by Robinson Brothers, the company taking the material on a royalty basis. It is dug with a Monigan steam drag-line machine with 2½-cubic yard bucket, loaded into selfdumping cars and transferred to the washing and sizing plant. Not much crushed rock is produced. The plant is of the ordinary type but with screens adjusted to give the sizes desired on the job. The following sizes are produced: $\frac{1}{4}$ " to $\frac{1}{4}$ "; $\frac{1}{4}$ " to $\frac{2}{4}$ "; $\frac{2}{4}$ " to $\frac{1}{4}$ ", though this size seldom runs over 4" to 5"; and sand. Equipment includes two Vulcan and one Porter steam locomotives, oil-fired, and cars, all

standard gauge. Electric power is used to operate the plant. At the time of visit it was being operated 18 hours per day, the production being 800 tons daily, and 45 men were employed. The dam is approximately 35% completed. When this job is finished the plant will probably be sold to some commercial producer or dismantled.

Los Banos Gravel Pit. Operations at this pit, near Los Banos, were discontinued by the former operators, C. E. and C. W. Wood, in the latter part of 1923, and it has since remained idle.

Marks Gravel Pit. Frank B. Marks, of Dos Palos, operates a gravel plant near the town of Dos Palos. The gravel is excavated with a drag-line scraper, operated by electric motor, delivered to the plant and screened to $2\frac{1}{2}$ -inch maximum size. Two men are employed.

Merced River Gravel Co.; address 531 W. Olive St., Turlock; C. C. Fleshman, superintendent. This company has a gravel plant on the



Crushed rock and gravel plant of Bent Bros., Inc., Bent's Pit, Merced County.

Drew Ranch on the Merced River, 1 mile east of Cressy Station on the Santa Fe Railroad. Operations began in March, 1924. The material is excavated by a 40-h.p. drag-line scraper driven by a gas engine, elevated to a revolving screen and sizes of $\frac{3}{4}$ " to 2" made. The oversize is crushed in a jaw crusher for road material. A Best 45-h.p. tractor is used for the power plant. The capacity is 150 tons per day, and the product is loaded direct to trucks.

SAN JOAQUIN COUNTY.

By C. McK. LAIZURE, Mining Engineer.

Introduction.

San Joaquin County was one of the original counties created in 1850. The only important change in its boundaries since that time was when a triangular piece lying north of the Stanislaus River was annexed to Stanislaus County in 1860. Stockton has always been the county seat.

Geography and Geology.

The county lies mainly in the great valley of the same name in the central portion of the state. It is bounded on the north by Sacramento County, on the east by Amador, Calaveras, and Stanislaus. The latter county extends around and adjoins it on the south also. Contra Costa and Alameda counties lie west of it.

Stockton, the county seat and largest city, has water transportation facilities, as well as rail. The area of the county is 1448 square miles, and its population is 79,905 (1920 census). By far the greater part of its area is made up of farm lands; the so-called 'delta' region adjacent

to Stockton being noted for its rich peat soil and heavy crops.

The most extensive geological formation exposed consists of unconsolidated sands, gravels and clays of Quaternary age, which compose the nearly level floor. The western edge of this formation follows closely the Southern Pacific Railroad line down the west side of the valley from Bethany to Vernalis. The corner of the county, southwest of the railroad, is composed of marine sandstone, and diatomaceous and clay shales of Tertiary and Cretaceous ages in the northern part. Its south half is rugged and broken, as the Franciscan rocks, typical of the Coast Range, including slates, cherts, limestones and sandstones with much schist and serpentine, are exclusively in evidence.

Unconsolidated sands, gravels and clays extend practically to the county line on the eastern side of the valley, the only other rocks exposed being two small areas of extrusive volcanic rocks, just east and

north of Bellota.

Mineral Resources.

Comparatively few mineral substances are found in San Joaquin County, and of these the most important are non-metallic structural and industrial materials and natural gas. Gold, silver and platinum have been obtained by dredging in Mokelumne River. In 1923, the last year for which complete returns are available, the mineral production of the county was valued at \$811,229, giving San Joaquin County twenty-sixth place in order of importance. Clay and clay products accounted for more than half the total.

In the following report on the county's mineral resources an endeavor has been made to mention all recorded mineral occurences of possible economic importance, whether developed or undeveloped. The total recorded output of the county (1885–1923) is given in the table herewith.



SAN JOAQUIN

V	Br	ick	Natural gas		
Year	М.	Value	M. Cubic feet	Value	
1885. 1886. 1894. 1894. 1895. 1896. 1896. 1899. 1900. 1901. 1902. 1902. 1902. 1904. 1904. 1905. 1906. 1907. 1908. 1909. 1909. 1909. 1910. 1909. 1910. 1910. 1910.	7,000 5,500 6,500 5,500 2,000 2,000 24,000 7,500 11,400 7,500 12,250 28,412 8,088 8,744 5,275 6,128	\$35,000 22,000 34,000 27,000 20,000 20,000 24,000 45,000 68,000 49,500 242,634 212,538 49,650 64,874 73,768	102,960 27,612 81,481 88,134 106,437 100,950 103,450 101,000 60,903 71,883 313,392	\$75,000 100,000 85,157 57,411 57,289 84,880 19,862 60,456 67,868 44,399 47,635 53,915 55,115 52,723 49,194 149,063 159,451 114,433 145,166 67,967	
1920	6,314 5,793 3,000 10,189 also	82,890 75,000 158,722	142,730 154,872 161,923 182,441 348,146 202,453 200,943 200,433 204,057 199,389	25,90 143,97- 141,60 72,58- 60,40 74,95 79,57 62,45	
Totals		3\$2,609,861		\$2,284,63	

¹Production of manganese ore in California began at the Ladd Mine, San Joaquin County, in the Tesla District in 1867. When shipments of this ore to England ceased late in 1874, upwards of 5,000 tons had been produced by that property. Annual amounts earlier than 1894 not separable.

²Estimated.

³See under 'Unapportioned'.

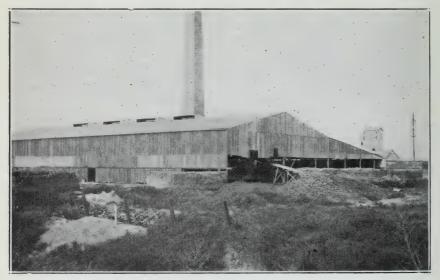
⁴Includes crushed rock, rubble, rip-rap, sand, gravel.

COUNTY, 1885-1923.

Manganese		Miscel- laneous	Miscellaneous and unapportioned				
Tons	Value	stone ⁴ , value	stone4,		Substance		
(1)				\$2,500	Gold.		
55 280	\$550 2,800		275 tons	343	Pottery clay.		
			273 tons 3 tons	2,730 90	Asphalt. Infusorial earth.		
		\$25,000					
60	1,080		2,000 tons	13,000 214,835	Clay. Unapportioned, 1900-1909.		
260	4,160		25,510 tons	25,510	Clay.		
150 460 6,493	1,500 7,400 115,460	900 19,440 21,620 53,075	{ 1,494 tons 3,000 tons	18,522 4,000 200 400	Clay. Glass sand. Other minerals. Other minerals.		
6,320 4,281 343 (3)	157,500 117,709 10,274	55,003 47,085 59,510 63,077		72 71,299 71,538 333,068	Other minerals. Gold, platinum, silver. Gold, platinum, silver. Brick, gold, manganese, platinum, silver		
(3)	3,750	72,815 (³)		23,530 314,269 96,672	Other minerals. Brick and clay. Manganese ore and miscellaneous stone		
(3)	(3)	260,597		472,858 77,774	Clay and clay products. Manganese ore and natural gas.		
319,127	\$422,183	\$678,122		\$1,743,210			

BRICK AND TILE.

San Joaquin Brick Co. I. F. Stine, secretary-manager; Ernest Rosi, plant superintendent; home office, 33 South El Dorado Street, Stockton, California. The property consists of 60 acres, situated on Roberts Island about five miles from Stockton, where railroad connections are made. The clay used is excavated with a Marion steam shovel mounted on a barge. An S. S. S. automatic brick machine, using the soft mud process, is used. A continuous cable system takes the brick from the machine. They are dried on racks for three to five days, and then burned in a Hoffman continuous-type kiln for about 72 hours. Coal is used for fuel. Common red brick is the only product. The plant is operated from April to November only. It has a capacity of 60,000 bricks daily. Electric power for operating the machinery is supplied



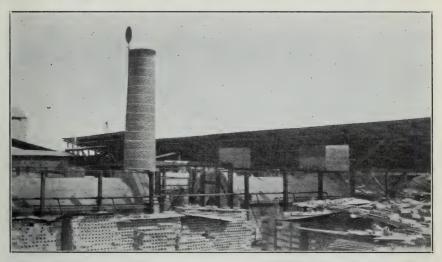
Plant of Stockton Brick and Tile Co., Stockton, California.

by the Pacific Gas and Electric Company, about 100 horsepower being required. Forty men are employed when operating.

Stockton Brick and Tile Co. Ralph Wilcox, president; Paul Weston, secretary; home office, 245 N. El Dorado Street, Stockton, California. This company's plant, which produces common red brick, is located on McKinley Avenue near the outskirts of the city, about one-half mile beyond the Municipal Baths. A Southern Pacific spur track runs to the plant. The plant was started in 1921. It has been closed down for overhauling of machinery, etc., since January, 1925, but operations are expected to begin again soon. The clay is dug under contract and delivered to the plant. The stiff mud process is used, the clay passing through a dry pan and then being elevated to the pug mill. From there it goes to the brick machine and cutter. The bricks are taken from the cutter belt, placed on cars and sent to the dryer. They are then burned in a Hoffman continuous type of kiln with a capacity of 450,000 brick, using coal for fuel. All machinery is operated by elec-

tric power. The plant has a capacity of 25,000 per day, and 20 men are employed when operating. G. Birtolini is plant superintendent.

Stockton Fire Brick Co. (Formerly Stockton Fire and Enamel Brick Co.) J. T. Roberts, president; Percy T. Claghorn, secretary; E. H. Horner, plant superintendent; address, P. O. Box 314, Stockton, California, or Rialto Building, San Francisco. The company's plant is on the line of the Southern Pacific Railroad at the foot of South California Street, Stockton. The output includes fire brick and other fire-clay products, such as runner brick and special hand-moulded forms. Raw clays from Placer and Amador counties are utilized. The stiff mud process is used, the materials passing through a dry pan and screens, then to a pug mill and auger brick machine, the entire process being continuous and automatic. From the brick machine



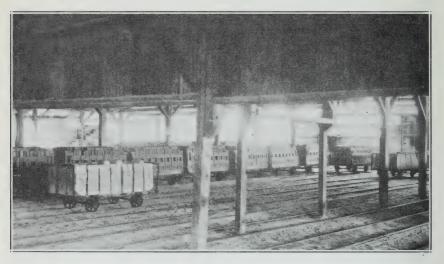
Stockton Fire Brick Company's Plant, Stockton, California. View showing special rectangular kilns for burning runner brick.

the bricks are stacked on cars holding 380 each and dried in ovens heated by waste heat from the kilns. Drying takes approximately 30 hours. There are twelve round down-draft kilns, and four rectangular down-draft kilns used for burning runner brick used by steel mills and iron foundries. The kilns vary in capacity from 20,000 to 100,000 brick (40 to 800 tons). Fuel oil is used, and the bricks are burned from seven to eight days to a temperature of 2,500°. It takes the same amount of time to cool down a kiln as it does to burn the charge. The plant is equipped with up-to-date appliances, and all operations are subject to close technical control. There is an efficient testing laboratory, fully equipped with electrical and optical pyrometers for measuring high temperatures; including also a special conductometer for measuring the insulating qualities of materials at high temperatures. The result of this technical supervision has been a high quality output, which is shipped to Alaska, Honolulu, Japan, the Philippines, and South American markets, as well as meeting local demands. An average of 110 men are employed.

CLAY.

Low-grade clays suitable for the manufacture of common brick are produced at several points in the vicinity of Stockton, and there are doubtless extensive reserves of material of this class. High-grade pottery and fire-clay deposits are rare, if not entirely absent in San Joaquin County. Along the line between San Joaquin and Alameda counties in the vicinity of Tesla and Carnegie excellent fire clay was at one time produced, and utilized at the plant (now dismantled) of the Carnegie Brick and Pottery Company. The plant was in San Joaquin County, but the clay was obtained from the Tesla Coal Mine on the Alameda County side.

Bibl: State Mining Bur. Preliminary Report No. 7, pp. 94-95; Bull. No. 38, pp. 227-228; State Mineralogist's Report XIV, pp. 607-610.



Stockton Fire Brick Company's Plant, Stockton, California. View showing drying track floor.

COAL.

Prospecting was carried on at an early day in the western part of the county in the vicinity of Corral Hollow and along Lone Tree Creek. Some narrow veins of coal, mixed with shaly matter, were found, but none of them have ever been brought to a productive stage.

Bibl: State Mineralogist's Report X, p. 564.

DIATOMACEOUS EARTH.

A specimen of diatomacious earth from San Joaquin County was presented to the State Mining Bureau Museum years ago. It is probable that the deposit represented is of little importance, as it has never been exploited.

Bibl: State Mining Bureau Bull. 91, p. 92.

GLASS.

Western Stockton Glass Plant. This plant, which is located in the western outskirts of Stockton near the Municpal Baths, was erected by the Stockton Window Glass Company in 1901. It operated for a time, but was closed down in 1908. Litigation followed, and the ownership changed hands a number of times, with intermittent operations. In 1911 it was purchased by the Western States Gas and Electric Company, but was later sold by them. According to a legal notice posted at the plant, M. Davidson is now sole owner. On January 26, 1925, a contract of sale was given by Davidson to George Dare, and it is reported that the plant is again to be started up. It was last operated four years ago.

GOLD, SILVER AND PLATINUM.

Gold dredging operations account for the output of gold, silver and platinum credited to San Joaquin County. These operations have been carried on for the most part in the Mokelumne and Calaveras rivers, above the San Joaquin County line. The holdings of the American Gold Dredging Company, on Mokelumne River, however, included some land in San Joaquin County, and during the years 1918, 1919, and 1920 this area was dredged. As a result, San Joaquin County became a producer of the precious metals for a short period. There is little hope of further production except possibly a small amount obtained as a by-product from crushed rock, gravel and sand plants that may be operated in the future in this district.

GYPSUM.

Gypsum in the form of selenite has been found near Vernalis. The occurrence is probably of no economic importance.

Bibl: State Mining Bur. Bull. 91, p. 27.

HEMATITE.

Earthy red hematite, as shale, occurs in Sec. 2, T. 4 S., R. 4 E., at the Ladd Manganese Mine.

LIMESTONE.

A limestone quarry was opened up in 1900, about one mile south of Carnegie. The stone was burned and the lime used for building purposes at Tesla and Carnegie. The deposit consisted of veins of aragonite from three inches to three feet in width, and there was much waste in quarrying. It has been abandoned for many years.

Bibl: State Mining Bur. Bull. 38, p. 79.

MANGANESE.

The first manganese mining in California was done in 1867 at the Ladd Mine, located in Sec. 2, T. 4 S., R. 4 E., San Joaquin County. This mine was opened up by A. S. Ladd and worked by him until 1874, during which time about 5000 tons of ore were shipped to

England. In 1874 it was bought by Justinian Caire, of San Francisco, but shortly afterward shipments of California ore to England were stopped by the impossibility of competing with Spanish manganese, so that comparatively little ore was shipped for many years. In 1916 the mine was taken over by M. C. Seagrave, of the Western Rock Products Co., San Francisco. During the war it became the largest single producer of manganese ore in the state.

All of the manganese deposits in San Joaquin County are associated with an extensive area of Franciscan formations, extending south and southeast of Tesla, and covering parts of Alameda, San Joaquin, Stanislaus, and Santa Clara counties. This area, consisting mainly of sandstones and serpentine with lenses of chert, is approximately 12 miles wide at its northern edge along the south side of Corral Hollow Creek. Three townships south of there it is at least 18 miles wide.

Exploration and development work have revealed three main mineralized belts in this area: 1. An eastern belt, largely of chert and containing deposits of manganese, some of them yielding ore of very good grade. Most of the deposits in San Joaquin County are in this eastern belt. 2. A western belt, largely of serpentine bodies, but with chert and sandstone also present. Deposits of manganese have been noted in the chert and a few of them, lying mainly in Alameda and Santa Clara counties, have been worked. 3. Between these two above-noted belts, at least in the northern part of the area in Alameda County, there appears to be a third belt showing deposits of manganese of lower grade than those of the other belts.

The manganese orebodies, whether veins or lenses, though occurring in somewhat regular belts as noted above, have no regularity of strike or dip. The individual orebodies strike through all the intermediate angles from N.-S. to E.-W. They occur as interbedded lenses in jasper, varying in extent and thickness as well as character. In places the ore is deposited as the porous black dioxide, but often merely as stains along cracks in the jasper. No large mines have been developed in San Joaquin County except the Ladd Mine, but a number of other prospects have been more or less productive. Activities here gradually

diminished since 1918, and ceased in the county in 1923.

Crocker Properties. This property includes about ten sections in San Joaquin County. M. I. Crocker, 1023 Insurance Exchange Building, San Francisco, owner. The principal deposit that has been noted is on Sec. 35, T. 4 S., R. 4 E. There has been no recent production.

Ladd Mine. Owned by Patrick Connolly, Tesla Road, Livermore; John Merchant, lessee, Livermore. The orebody at this mine strikes N. 10° to 30° W., dipping southwest from quite flat to nearly vertical. It has been exposed along the strike for 2000 feet, varying in width up to 30 feet, but averaging four or five feet. The ore in the main body is the hard, massive oxide, black or steel gray in color, and without crystalline structure, so that it is impossible to distinguish the particular oxide present, manganite, psilomelane, or pyrolusite. In the lowest tunnel rhodochrosite, the carbonate of manganese, occurs. It has been opened up by both tunnels and shafts. The ore is handled by truck to Livermore. The most recent production was made in 1923 by John Merchant, of Livermore, since which time it has been idle.

Winship Properties. This property, owned by the K. D. Winship Estate, 350 Post Street, San Francisco, includes about eight sections of land in San Joaquin County, on some of which manganese ore has been developed and shipments made by various lessees. The principal occurrences are in Secs. 3, 11, and 13, T. 4 S., R. 4 E., and Sec. 19, T. 4 S., R. 5 E. Sec. 11 adjoins the Ladd Mine on the south, and shipments have been made from both sections 11 and 13. There has been no recent production.

Bibl: State Mineralogist's Reports X, p. 564; XIII, p. 507; XIV, pp. 621–622; State Mining Bur. Bull. 76; U. S. Geol. Survey Bull. 427.

NATURAL GAS.

One of the peculiarly elusive and at the same time very valuable mineral resources of San Joaquin County is natural gas. All of the natural gas produced in the county at the present time comes from wells located within the city limits of Stockton. The present and potential value of this fuel to the city and the surrounding country has been recognized by the public officials of Stockton, and, in cooperation with them, the State Mining Bureau, in 1923, prepared a tentative outline for a survey to determine the natural gas possibilities of the Stockton area, and the maximum territory that could be economically served by it, if an ample supply were developed. These areas are shown on the accompanying outline map of the central valley counties, with Stockton as the hub.

In considering such an investigation, the following points were emphasized: (a) That the survey should be under the technical direction of the State Mining Bureau; (b) a preliminary investigation should be made to bring down to date all existing data relative to occurrence and production of natural gas within an approximately rectangular area, with Stockton as its center, 200 miles in length and of an average width of 75 miles; an area covering, therefore, approximately 15,000 square miles; (c) any locality, to be considered as coming within the survey, should be closer to Stockton than to the oil fields of Midway and Elk Hills; (d) transportation is one of the primary limiting factors in gas utilization. There is an adequate gas supply in the Elk Hills in Kern County for use in Fresno, Hanford, and Visalia, but the amount that would be used there does not justify the investment in transportation facilities. Assuming that a supply of gas could be developed near Stockton in quantity equal to the potentialities of Midway and Elk Hills, Fresno would be just as far from Stockton as from Midway, and therefore no more likely to be a user of Stockton gas. (e) It would be well to determine how much gas can be used by communities lying within a radius of 75 miles of Stockton.

The carrying out of the program is being held in abeyance until the necessary funds can be provided.

Western States Gas and Electric Co. Samuel Kahn, vice president and general manager; B. F. Wellington, secretary, Stockton, California. This company has an extensive gas manufacturing plant and electric plant, and is the owner of all the producing gas wells in the



Portion of Central California Relative to Natural Gas Possibilities

Stockton area. It has a total of 17 wells, of which 11 are producing gas at present. The natural gas is all piped to the central plant and mixed with manufactured gas before going to the consumer. The water flowing from the wells is not utilized except in the case of Jackson No. 1 and Jackson No. 2 wells. The flow from these two is made use of at the Municipal (Jackson) Baths. None of the water from the gas wells is suitable for irrigating, as it is brackish.

All of the company's producing gas wells are equipped with compressors, operated by electric power, which compress a portion of the gas collected in the receiver. This compressed gas is forced down the well in a pipe and as it escapes at the bottom it helps to decrease the pressure of the water column, and thus increases the natural flow

of gas from the well.

Flow conditions of the various wells and physical data regarding them were published in Report XIV of the State Mineralogist (1913-1914), and for comparative purposes the present status of each well is given below:

Well (No. 1 of old Central Natural Gas Co.) This well was revived by use of a compressor. There is no water or gas flow except when the compressor is running. Present production, 14,000 cu. ft. per day.

Well No. 1. Now flowing. Production, 25,000 cu. ft. per day.

Well No. 2. Dead.

Well No. 3. Dead. Repair work was being done on this well when it went dead. Within 24 hours well No. 1, formerly dead, began flowing.

Well No. 4. Dead.

Well No. 5. Producing 27,000 to 28,000 cu. ft. per day.

Well No. 6. Producing 16,000 cu. ft. per day. Well No. 7. Producing 40,000 cut. ft. per day. Well No. 8. Producing 60,000 cu. ft. per day.

Well No. 9. Producing 120,000 cu. ft. per day. This is the most productive and best well owned by the company.

Well No. 10. Dead.

Well No. 11. This is a new well located on Lot 4, Block 42, Gardendale Tract, near the end of Charles Street. It was drilled in 1916 to a depth of 3100 feet, 10-inch casing to 3040 feet, and St-inch casing for the balance of the distance. The water flow is approximately 1000 gal. per minute. Producing 50,000 cu. ft. of gas per day.

Citizen No. 1. Dead.
Citizen No. 2. Producing 39,000 cu. ft. per day.
Jackson No. 1. Producing 9000 cu. ft. per day.
Jackson No. 2. There is a water flow but practically no gas. The water formerly had a temperature of 84° F., but it is now cooler.

Glass Works No. 1. Producing 25,000 cu. ft. per day. Glass Works No. 2. Producing 15,000 cu. ft. per day.

Bibl: State Mineralogist's Reports X, pp. 548-564; XIV, pp. 184-195.

PETROLEUM.

The areal geology of San Joaquin County is composed almost entirely of Cretaceous, Tertiary and Quaternary formations, which do not contain any indication of the presence of petroleum. Though yet unproved, there is no positive evidence that petroleum does not exist in buried structures beneath the valley floor, and only the drilling of test wells will definitely settle the question. Preliminary work along this line has been undertaken, and these activities are reported in the current issues of 'Summary of Operations, California Oil Fields,' to which the reader is referred. The oil possibilities from a geological standpoint are discussed in the publications given in the bibliography.

Bibl: State Mining Bureau Bull. 89; U. S. Geological Survey Bull. No. 603.

STONE INDUSTRY.

Crushed Rock, Gravel and Sand.

Arington and Putman Pit. Owned by Arington and Putman Sand and Gravel Co., P. O. Box 271, Escalon, California. The property, containing 24 acres, is located about one mile north of Riverbank in Sec. 24, T. 2 S., R. 9 E., on a spur track of the Santa Fe Railroad. Operations began in September, 1924. The deposit contains about 25 per cent gravel and 75 per cent sand. The sand and gravel strata have a total depth of about 25 feet, with clay underneath. At present the material is excavated by a steam hoist, using a Le Claire drag-line



Plant of Arington and Putman Sand and Gravel Co., San Joaquin County.

scraper, but it is the intention of the company to put in a steam-shovel. The material is elevated, run through a revolving washer and sand screen and then a gravel screen, giving three separate products, sand, pea gravel and a coarse gravel, or a concrete mixture of various sizes. Electric power is used, about 50 horsepower being required, except for the steam-hoist. The latter uses crude oil for fuel. Oversize gravel is crushed in a jaw crusher to $1\frac{1}{16}$ inch, and mixed with the coarse gravel product. The capacity of the plant is 300 tons per day, and three men are employed.

Bellota Gravel Pit. A crushed rock, gravel and sand washing and screening plant is located at Bellota, the terminal of the Stockton Terminal and Eastern Railroad, about 17 miles northeast of Stockton. The deposit is on the Mormon Channel of Stanislaus River. Gould and Johns, 123 South California Street, Stockton, were the former operators, but, due to litigation, the plant has not been operated during 1925. Electric power was used and the plant could probably produce 250 to

350 tons per day. It is understood that D. G. Johns, 434 E. Maple Street, Stockton, is now the owner.

Miller Gravel Pit (formerly Myers Pit). S. D. Miller, P. O. Box 314, Manteca, California, has a pit from which he is producing sand and gravel, in the S½ Sec. 17, T. 2 S., R. 8 E. The pit is located about three miles south of Escalon near the point where the Tidewater Southern Railway crosses the Stanislaus River. It was originally opened up by the Railroad Company as a source of ballast. Later it was leased and operated by the South San Joaquin Irrigation District. The present owner has been operating it the past two years. The washing plant is on a spur of the Tidewater Railroad, the site being leased. Area of deposit, ten acres. It consists of bench gravel and sand, adjacent to the present Stanislaus river channel. The material is mostly small gravel and sand, with very few boulders as large as a



Miller Gravel Pit, San Joaquin County, California.

man's fist. It is brought to the plant by teams and Fresno scrapers, elevated and run over a screen, the gravel and fine sand being washed separately and then both run together to railroad cars for shipment. Two gas engines are used, one to run the elevator and the other to pump water for washing. There are no crushing or storage facilities in the present plant, but bunkers for a new plant have been erected. The capacity is about 200 tons of bank-run material per day, using two teams. Three men are employed. The material carries a cent or two a yard in gold.

Riverbank Sand Co.'s Property. Owned by the Riverbank Sand Company, Escalon, California, or 704 Market Street, San Francisco; Wm. H. Ford, president; B. R. Kimberling, plant superintendent. This property known as Santa Fe Gravel Pit contains nine acres, located in Sec. 23, T. 2 S., R. 9 E. Riverbank, the nearest town and railroad station, is 1½ miles south of the pit. The present company has been operating about eight years. The deposit is mostly fine gravel

and sand, containing only about two per cent of coarse gravel. The material is excavated by a gasoline drag-line scraper with a half-yard bucket mounted on caterpillar tracks, and loaded into hopper bottom cars. These are hauled by a gasoline locomotive to the washing plant hopper and dumped. The material is elevated by a bucket elevator, and passed through a revolving screen with 1-inch holes and jacket, giving a concrete sand from 1-inch down and a plaster sand of 8-mesh size. The plant is on a spur track of the Santa Fe Railroad, and the cars are loaded direct. Electric power is used for operating and pumping the wash water, a total of 40 horsepower being used. The plant has a capacity of about 300 tons per day, and three men are employed. Large quantities of the sand have been used as a gunite sand in lining irrigation ditches in the South San Joaquin Irrigation District.

River Rock Gravel Co. Wm. H. Ford, president; home office, 704 Market Street, San Francisco; Earl Williams, general manager at



Pit of Riverbank Sand Co., near Escalon, San Joaquin Co., California.

plant, local address, Tracy, California. This plant, which is of excellent design and operated entirely by electric power, is located seven miles south of Tracy on a branch line of the Western Pacific Railroad. It is situated on Tesla Creek at the mouth of Corral Hollow Canyon near the point where the creek breaks into the basin of the San Joaquin. The surface here is fairly level, the elevation at the plant being approximately 135'. There is no timber. The area of the company's holdings is 90 acres. Operation of the plant began in 1916. material utilized is sand, gravel, and boulder wash from the bed of Tesla Creek. This wash extends up the creek for 15 miles above the plant. The creek is subject to heavy floods during the rainy season, and much material is brought down during these floods, partly replenishing the supply. The material is taken from the creek bed by an electric drag-line excavator and loaded onto a grizzley car. This is a standard gondola car with a superstructure of inverted 56-lb. rails set at an angle of about 45° and spaced so as to eliminate all boulders too large for the primary crusher, a No. 5-K gyratory. This car is

hauled by a 12-ton electric locomotive to the dumping pit at the plant. From the pit the material is carried by a belt conveyor to the highest point of the washing plant. The material delivered by the conveyor is classified into large size (3" grizzley) for the gyratory, medium size (15/8") for the disc crusher, and the balance for the conical screens. The discharge from the gyratory and disc crushers is run by separate belt conveyors to independent conical screens. The main conveyor is arranged so that material from any bin in the washing plant can be fed onto it for mixing purposes. This mixed material or a regular sized product can be run to bins, cars or storage. The finished materials supplied are No. 1 gravel, 1" to $1\frac{1}{2}$ "; No. 2, $2\frac{1}{2}$ " to 1"; No. 3, $\frac{1}{4}$ " to $\frac{1}{2}$ "; No. 4, sand to $\frac{1}{4}$ "; No. 5, crushed rock, $\frac{1}{4}$ " to $\frac{5}{8}$ "; No. 6, crushed rock, $\frac{5}{8}$ " to $1\frac{1}{4}$ "; No. 7, crushed rock, $1\frac{1}{4}$ " to $1\frac{3}{4}$ "; No. 8, cementing road gravel. Water sprays are placed in each conical screen and assist in moving the material, as well as washing it. The electric drag-



Plant of River Rock Gravel Co., near Tracy, San Joaquin Co., California.

Photo by courtesy of River Rock Gravel Co.

line excavator has a 1½-yard bucket. The electric locomotive and locomotive crane are operated by the third rail system, eliminating all overhead structures near the tracks and permitting free use of the booms at any point. The water supply is obtained from springs in the canyon and is pumped 3650 feet in a 10" wooden pipe. The water is returned to a settling pond, the overflow of which goes to a second reservoir. Fine material, which settles, is removed as occasion demands and sold for filling. A small auxiliary plant supplies the cementing road gravel, which is obtained by digging below the gravel stratum and including a portion of the underlying clay. Power is furnished by the Pacific Gas and Electric Company. The plant is operated one 9-hour shift daily, and 16 men are employed. The present capacity is 1000 tons daily, but the plant is designed for 2000 tons and this can be obtained by adding screens to the other half.

Stockton Mineral Products Co. A. B. Foote, president; E. W. True, manager; home office at the plant, 402 West La Favette Street, Stockton, California. There is a Southern Pacific spur track and Western Pacific connection to the plant. The products are white and colored roofing and stucco 'dash' rock. The crude materials consist of quartz and mariposite from near Jamestown, dolomite from near Sonora, light and dark red rock from Ione, and green rock from Yosemite Valley. supplied under contract by local producers. A new unit to the plant is under construction. In the original unit the material was fed to a 10" x 18" Dodge crusher, elevated to a revolving screen which delivers three sizes of roofing grit; the oversize passing through 14" x 24" rolls in closed circuit. In the new unit, material from the bins in the first unit is elevated to a 2-unit Hummer vibrating screen at the top of plant, which delivers various fine products. The oversize goes to a small hammer mill in closed circuit. Electric power, furnished by the Pacific Gas and Electric Company, is used, about 50 horsepower being required. When completed, the plant will have a capacity of 400 tons of finished materials per month.

Western Pacific Pit. W. A. Bechtel, contractor, 625 Market Street, San Francisco, is producing 'pit run' gravel and sand for the Western Pacific Railroad Company from a deposit along their right of way about one mile southwest of Carbona. The material is wash brought down by Tesla Creek. A Bucyrus steam shovel, with 1\frac{3}{4}-yard bucket, is used, and the gravel is loaded direct to railroad cars. The railroad company is utilizing it for track ballast and filling in the vicinity of Stockton. Operations began March 1, 1925.

STANISLAUS COUNTY.

By C. McK. LAIZURE, Mining Engineer.

Introduction.

Stanislaus County was created on April 5, 1854, from territory previously a part of Tuolumne County. In 1860 a triangular piece north of the Stanislaus River, and including Knights Ferry, was taken from San Joaquin County and added to Stanislaus. With this addition, the county boundaries became practically the same as they are today. Knights Ferry was made the County Seat about this time, but later the county offices were transferred to Modesto, the present County Seat.

Geography and Geology.

Stanislaus County is situated in the San Joaquin Valley between San Joaquin County on the northwest and Merced on the southeast. It is bounded on the northeast by Calaveras and Tuolumne counties, and by Santa Clara on the southwest side. Stanislaus County contains 1486 square miles, and its population is 43,557 (1920 census). The greater part of its acreage is arable, and about one-half is capable of irrigation. The various branches of agriculture and stock-raising are the principal pursuits followed.

The county extends across the San Joaquin Valley in a northeasterly direction from the summit of the Mt. Diablo Range on the west to the foothills of the Sierra Nevadas on the east. The central portion is

composed of unconsolidated sands, gravels and clays. Bordering this formation on the northeast, with the line of contact a little above Oakdale and Waterford, is a belt of older Tertiary clays, shales and sandstones. This Tertiary belt extends to and comes in contact with the slates, limestones and other rocks of the Jurassic along a line which closely follows the northeastern boundary of the county. On the southwest, the low foothills of the Coast Range are made up of Cretaceous sandstones and shales. The extreme western portion is rugged and composed of Franciscan formations, typical of the Coast Range; consisting of altered slates, cherts, massive sandstone, schists and serpentine. Deposits of magnesite, manganese and quicksilver occur in this area.

Mineral Resources.

Gold has usually been the chief mineral product of Stanislaus County, but gold was exceeded in value in 1918–1919 by manganese, and in 1921–1923 by miscellaneous stone. Gold, platinum and silver are obtained mainly by dredging. Quicksilver and manganese are other metals found here also. Among its non-metallic resources are clay and clay products, ocher, magnesite, silica, and miscellaneous stone, including crushed rock, gravel and sand. Other minerals occur, but the deposits in most cases have not been sufficiently developed to determine their commercial value. The value of the counties' mineral products has exceeded a half million dollars in some years. In 1923 the output amounted to \$445,515, which was slightly less than in 1922. This gave the county thirty-third place for that year, with 25 counties showing a smaller output.

In the following report an endeavor has been made to give a complete summary of the mineral resources of the county so far as they are known at this time, but only active properties are described in detail.

The total recorded output from 1880 to 1923 is shown in the following tabulation:

STANISLAUS

Year	Gold, value	Silver, value	Brick		Magnesite		Manganese	
			M.	Value	Tons	Value	Tons	Value
1880	\$73,271							
1881	63,000	\$31,000						
1882	80,000	15,000						
1883	40,000	5,000						
1884 1885	40,000	5,000						
1886	18,660 47,175							
1887	53 297							
1888	53,297 75,000							
1889	20,410							
1890	5,335							
1891	3,000							
1892	14,191							
1893	150							
1894 1895	26,369							
896	26,482 16,635							
1897	37,392							
1898	19,400							
899	10,000							
1900	121,212							
1901	115,700				100	\$600		
1902								
1903	152,869	256						
904	150,000	265						
1905	150,000	240						
1906	(3)	(3)						
1907	3,364	28						
1908	(2)	(2)	750	\$7,000				
1909 1910	(2)	(2)	5,000	50,000				
1911	1214,187 1307,538	1604 41,131	1,500 850	8,000 5,950				
1912	1226,163	11,974	250	2,000				
1913	5253,166	5671	300	2,400				
1914	(2)	(2)	250	2,500				
1915	(3)	(3)						
916	(3)	(3)	(3)				160	\$2,400
917	(3)	(3)			3,196	44,350	775	26,92
918	14,196	592			2,024	18,038	5,753	222,422
919	(3)	(3)			2,031	20,831	8,921	374,584
1920	142,467	775			4,064	39,435	893	12,978
921	18,439	136			3,378	33,158	(3)	
1922	(3)	(3)			2,400	35,475	(3)	(3)
1923	174,814	833						
Totals	3\$2,313,882	3\$63,505	38,900	\$77,850	17,093	\$191,287	³16,502	\$639,304

¹Includes Merced County.

²See Merced County.

³See under 'Unapportioned.'

⁴Includes Merced County production; also dredge yield of Shasta and Trinity Counties.

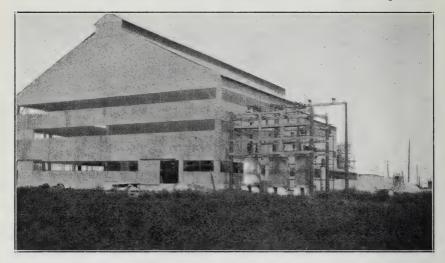
⁵Includes dredge production of Merced and Siskiyou Counties.

COUNTY, 1880-1923.

Mineral paint		Miscel- laneous	Miscellaneous and unapportioned				
Tons	Value	stone, value	Amount	Value	Substance		
105	\$2,310		00 0 1	2000	0-1-1-11		
375 17	2,800 1,800		20 flasks	\$800	Quicksilver.		
152	1,825						
283	2.898						
204	1.769						
129	193						
200	375		79,330 lbs.	12,494	Copper.		
200	350		162,400 lbs.	18,676	Copper.		
1,370	2,400		116,600 lbs.	15,080	Copper.		
200	1,600		7,300 lbs.	931 20	Copper. Platinum.		
375	2,125		(20	riamum.		
250	1,720						
250	1,720						
285	2,000	\$74,000					
285	2,225	225		82,317	Unapportioned, 1900-1909.		
40	270						
96	600	62.570					
100 255	600 1,530	$\begin{array}{c} 63,572 \\ 14,482 \end{array}$					
52	286	3.096					
(3)		2,250		189,521	Gold, mineral paint, silver, platinum, quick- silver.		
507	2,200	17,784		230,638	Chromite, brick, gold, platinum, quicksilver silver.		
(3)		6,240	{ 1,438 tons	29,240 183,167	Chromite. Gold. mineral paint, platinum, silver.		
498	3,088	38,764	1,352 tons	56,505 308	Chromite. Other minerals.		
(3)		28,922		1165,989	Gold, mineral paint, platinum, silver,		
669	7,062	181,262		1,043	Platinum and quicksilver.		
(3)		180,697		3,777	Manganese, mineral paint, platinum, quick-		
(3)	(3)	299,962		116,730	silver. Gold, manganese ore, mineral paint, platinum		
1,023	10,745	231,965		27,158	and silver. Magnesite, manganese ore, platinum.		
a7,920	354,491	\$1,143,221		\$1,134,394			

BARIUM PRODUCTS.

D-V-O Products, Inc. C. E. Gilman, president; Norman de Veaux, vice president, 1101 Oakland Bank Building, Oakland; Albert Breed, secretary; home office, 102 Olive Avenue, Modesto, California; Alexander Bonnington, plant manager, Modesto. D-V-O Products, Inc., is a close corporation, organized for the purpose of manufacturing a number of chemical and allied products. The main materials to be utilized include a number of crude minerals. Insecticides, hydrogen peroxide, pigments, and lime sprays will be made. Raw materials will consist mainly of limestone; barytes, either barite or witherite, and beet molasses. The plant, which is of concrete and steel frame construction, is expected to start about July 1. Much equipment in the form of machinery and apparatus is already installed, and about 1500 tons of barytes are on hand. Steam boilers of 250 horsepower are installed to furnish steam for processing, and the plant is equipped for 1600 electrical horsepower for operation, although this amount will not be required at all times. When the period of normal operation



Plant of D-V-O Products, Inc., Modesto, California. (Under construction.)

is reached, the daily consumption of raw materials is expected to be from 10 to 20 tons of off-color barite, or up to 80 tons if white barytes can be obtained; 20 tons of limestone and 60 tons of molasses, and it is estimated that 100 men will be employed.

CLAY.

The true nature, value and extent of the clays in Stanislaus County are practically unknown, as they have been utilized only in a very limited way. High-grade pottery clay probably occurs, if at all, in limited amount, but deposits of low-grade clay, suitable for the manufacture of common brick, have been worked at various times in the past near Modesto, Grayson, Newman, and Patterson.

At the present time there is no brickyard in operation in the county,

and none of the clay is being used for any purpose.

The Craycroft brickyard at Modesto produced regularly between 1908 and 1916, but it is now dismantled, and the land has been sold for town lots.

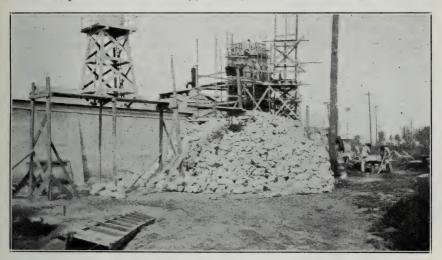
Some bricks were manufactured in 1918 and 1919 by Martin Kelch from a clay deposit having a maximum thickness of 20 feet, situated on the Waterford road, about one mile east of Modesto. Operations were discontinued here in 1919.

There is a deposit of clay in Secs. 20 and 21, T. 5 S., R. 7 E., about 3½ miles northeast of Patterson, which is said to analyze about 60% silica, 24% alumina, 3% iron, and a little magnesia. It is not being utilized.

Bibl: State Mineralogist's Report XVII, p. 253; State Mining Bur. Prel. Report No. 7, p. 99.

COAL.

Small veins of coal have been discovered from time to time in the southwest portion of the county, notably on Ensalada Creek in Sec, 12,



Plant of D-V-O Products, Inc. (under construction), showing stock of raw material on hand.

T. 6 S., R. 7 E., and in Ingram Canyon, near Sec. 12, T. 5 S., R. 6 E. A vein of coal, 2 feet in thickness, is said to have been passed through in boring a well on the David Hoges Ranch, 13 miles northwest of Newman. None of these deposits has been thoroughly investigated, and they remain undeveloped.

Bibl: State Mineralogist's Reports X, p. 581; XVII, p. 253. U. S. Geol. Survey Mineral Resources, 1892, p. 310.

CHROMITE.

Stanislaus County became a producer of chrome ore early in 1916, its existence up to a short time previous having been unsuspected. A total of several thousand tons was subsequently shipped out of the county, principally to steel plants. The deposits are situated on the east

slope of the Coast Range Mountains, in Del Puerto Canyon and its branches.

The occurrences of chrome ore in this region may be grouped under two heads: (1) Lenses of hard massive black ore, containing little or no serpentine, and having a well-defined contact with the surrounding serpentine, and (2) deposits of gray ore mixed with the serpentine and grading into it. The serpentine belt is fairly extensive here, striking northwestward, with the trend of the mountains, and being evidently a continuation of that in which the Cedar Mountain deposits of Alameda County occur.

In this same area are located the Red Mountain magnesite deposits, as well as several old quicksilver mines; namely, the Adobe Canyon,

Deer Park and Phoenix mines.

Activities reached a maximum during the period of high prices due to the world war. The Patterson and Western Railroad (narrow guage) had been built from Patterson up Del Puerto Canyon to the foot of Red Mountain, 23 miles, to Camp Jones, principally to facilitate shipments of manganese from Santa Clara County properties, but giving access to the chromite deposits, as well. A half dozen properties were opened up in the vicinity of Camp Jones, including that of the Chrome Concentrating Co., which erected a concentrating mill; the Lucky Girl Prospect; the McGuire, Holbrook and Springer Property; the Mineral Product Co's Property, and the Plattner Deposit. All work ceased, however, in 1918 with the ending of hostilities and consequent collapse of the chrome market. The railroad has since been torn up, and all mine surface equipment dismantled. While these deposits are valuable as an emergency reserve source of chrome ore, under present market conditions they can not be profitably worked.

Bibl: State Mining Bur. Bull. 76, pp. 203-205.

DIATOMACEOUS EARTH.

Diatomaceous earth of good quality occurs in the hills west of Newman, and Crows Landing. The white outcrops can be traced for long

distances in this county and further south into Merced County.

In places these diatomaceous shale beds reach a thickness of several hundred feet. Notable deposits are found in the low hills between Orestimba and Little Salada Creeks. J. G. Walker et al located a claim here about 1920. There has been practically no development on any of the deposits, but they have considerable potential value.

Bibl: U. S. Geological Survey Bull. 603, p. 211.

GOLD, SILVER AND PLATINUM.

Two gold quartz mines are of record in this county: The Alto, near Knights Ferry, long since abandoned, and the Don Pedro, near Cooperstown, now included in Turlock Irrigation District reservoir site.

The production of the precious metals, with the exception of occasional small amounts obtained by 'crevicing' on the rivers, now comes entirely from gold dredging operations on the Tuolumne River near La Grange.

The dredge of the Yankee Hill Gold Mining Co., which began digging in the Stanislaus River, 1½ miles below Knights Ferry in November,

1920, was soon after torn from its moorings and wrecked on a sand bar above Orange Blossom bridge east of Oakdale. It was later sold and dismantled.

La Grange Gold Dredging Co. John G. Barker, president, C. E. Taber, secretary, 321 Union Oil Building, Los Angeles. Home office, La Grange; H. G. Kumle, superintendent. This company owns a large acreage in T. 3 S., R. 13 E., and T. 4 S., R. 14 E., about 400 acres of which are classed as dredging land. Of this area, about 65 per cent has been worked out, and 35 per cent remains to be dredged. The dredge is at present digging in the Tuolumne River near the outskirts of La Grange. Cooperstown, on the Sierra-San Francisco Railroad, is the nearest railroad station. River gravel bars, exclusively, are worked. The company operates one dredge. It has a wood hull, 42'-7" x 110' x 9½' deep, and was completed and put in commission



Gold dredge of La Grange Gold Dredging Co., on Tuolumne River, Stanislaus County.

three years ago, replacing an older dredge. It is equipped with $9\frac{1}{2}$ cu. ft. buckets, close connected, and can dig 40 feet under water. The average depth of the ground being worked is 32 feet. There is very little clearing of brush or timber required, but a good many large boulders are encountered. Electric power is used, furnished by the Pacific Gas and Electric Company. The connected load is 515 horse-power. The gold recovered is fine, but of good grade. Platinum and iridium comprise approximately two per cent of the total value recovered. The recovery of platinum metals has been increased by the use of cocoa matting in the sluices. During the year 1924 a total of 1,698,791 cubic yards of gravel was handled, with a recovery of 11.64¢ per yard, at a cost of 6.24¢ per yard, not including depreciation or depletion.

The dredger crew consists of ten men, and an equal number are employed outside and in the shops. In addition, two drilling crews are

kept busy prospecting the ground, requiring about seven men, making a total of 27 or 28 men.

Bibl: State Mineralogist's Reports X, p. 681; XII, p. 294; XIV, p. 629; XVII, p. 254; XVIII, p. 103. State Mining Bur. Bull. 57, pp. 209–211; Bull. 85, pp. 33, 100–101.

GYPSUM.

Gypsum in the form of selenite has been found in the vicinity of Modesto, but no massive deposits of commercial value are known.

Bibl: State Mining Bur. Bull. 91, p. 272.

HEMATITE.

A foliated variety of hematite, of mineralogical interest only, occurs near La Grange.

Bibl: State Mining Bur. Bull. 91, p. 103.

MAGNESITE.

That magnesite deposits occurred on the Stanislaus County side of the Coast Range at several points from Red Mountain south was known for many years, but little attempt was made to exploit them prior to 1916. Active development began about that time due to the building of the Patterson and Western Railroad from Patterson to the foot of Red Mountain, and the insistent demand for magnesite created by war conditions. Production was fairly steady from 1917 to 1922, averaging from 2500 to 3000 tons annually. The output decreased in 1923

and ceased entirely in 1924.

The Bald Eagle claim, in Sec. 32, T. 8 S., R. 7 E., and the Quinto claim, in the south half of the same section, together with other claims, were mined under lease during 1917 and part of 1918 by the Gustine Magnesite Co. These claims were all on Quinto Creek, about 16½ miles west of Ingomar, near the Merced County line. The Howard Cattle Company, Sharon Building, San Francisco, own Sec. 5, T 9 S., R. 7 E., on which a large body of magnesite was opened up and mined by lessees. In places on this property the ore was stoped for a width of 12 feet, and several thousand tons were shipped from here. The Plastic Magnesite Company leased a deposit located in Sec. 32, T. 8 S., R. 7 E., and were producing about 30 tons daily in 1920. Magnesite also occurs in Sec. 28, T. 7 S., R. 6 E., but it has been only slightly prospected.

In the Red Mountain area, G. L. Fenster et al., of Patterson, own five claims in Sec. 22, T. 6 S., R. 5 E., on which there is a ledge about nine feet in width, only slightly developed. Adjoining, in Sec. 20, T. 6 S., R. 5 E., is the Red Mountain Magnesite mine (California Magnesite Co.). This property has been the most important producer of

magnesite in Stanislaus County.

California Magnesite Co. G. A. Scott, president; M. W. Kirk, secretary; home office, Fifth and Parker Streets (Blanding Iron Works), Berkeley; J. Frame, superintendent, Patterson, California. This mine is situated on the Stanislaus County side of Red Mountain in Sec. 20,

T. 6 S., R. 5 E., at an elevation of 2500'. There is no timber but considerable brush. A large spring supplies all the water needed.

The property consists of four claims and a mill site, a total of about 85 acres. The deposit was discovered in 1915 by James and Plunket. The original company was known as the Red Mountain Magnesite Co.



View near head of Del Puerto Canyon, Stanislaus County, showing Red Mountain in background and California Magnesite Co.'s mine (white spot in middle distance).

Later it was called the W-K Co. In January, 1922, it was reorganized as the California Magnesite Co.

The deposit consists of parallel lenses of high-grade magnesite in serpentine country rock, of which Red Mountain is composed. Operations have been by glory hole and stoping from the main tunnel level.

6—39006.

Two lenses, 18 feet and 25 feet wide respectively, at the tunnel level have been stoped from there to the surface. The main tunnel, which is 1300 feet in total length, has apparently cut the top of two other lenses. The orebodies strike N. 20° W. and dip about 85° into the mountain. The total production since the mine was opened up has been approximately 50,000 tons. This was calcined in part at the mine and also at the calcining plant of the Mineral Products Co. in Patterson, which was taken under lease. The calcining equipment at the mine consists of a shaft furnace of 15-tons daily capacity and a small rotary furnace used mainly for burning fines. Crude oil is used for fuel. Mine equipment consists of two 70-h.p. boilers, a 7-drill Ingersoll-Rand compressor, steam hoist and pumps for handling the water supply, and fuel oil. There is also a 25-h.p. gas engine and 2-drill Sullivan Compressor, cars, track, etc. The camp buildings will accommodate about 30 men.

Practically all ore above the present adit was taken out and the mine was shut down in September, 1923, pending additional development. Another adit about 250' below the upper one had just been started to cut the orebodies exposed in the upper adit. This adit will

have to be driven about 900 feet to reach the ore.

Negotiations are now under way looking to the immediate completion of the new adit and resumption of full operations. It is probable that this move will include taking over the calcining plant of the Mineral Products Co. and possibly the moving of the 90-foot rotary kiln, with which it is equipped, to the mine as it has proved more economical to burn the magnesite at the mine than to transport the crude material. The road bed of the former Patterson and Western R. R., which ran from Patterson to the foot of the Red Mountain, makes an excellent graded road to within a short distance of the mine, so that the property is not difficult of access.

Bibl: State Mineralogist's Report XVII, p. 254. State Mining Bur. Bull. 38, p. 33; Bull. 79.

Mineral Products Co. James Spaulding, Trustee, care W. P. Fuller and Co., 301 Mission Street, San Francisco. This company was organized in 1915, and acquired extensive manganese and chrome deposits in Santa Clara and Stanislaus counties. They constructed the Stanislaus and Western Railroad from Patterson to the foot of Red Mountain, and a 2-foot gauge gasoline tramway, 5 miles in length, from the railroad to the mines. A plant for the manufacture of manganese dioxide was erected in Patterson but later developments in the manganese and magnesite situation led them to abandon the first idea, and the plant was converted into a calcining plant and factory for the manufacture of magnesia products. A 90-foot rotary kiln was installed and much other machinery. It did not prove a financial success, and the plant was shut down, and the company passed into the hands of a receiver. Negotiations are now under way looking to the utilization of the calcining equipment by the California Magnesite Co.

MANGANESE.

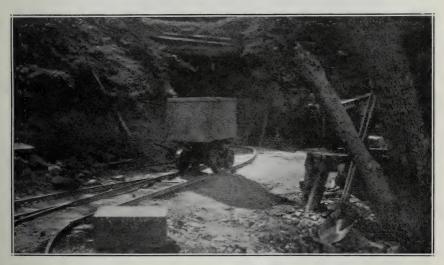
The manganese deposits occur in the southwestern part of the county, being found in a southeasterly extension of the area of Fran-

ciscan rocks referred to in more detail in the report on San Joaquin County.1

The California Manganese Co. was one of the first operators to start development in Stanislaus County. This company controlled five unpatented claims and 2160 acres of patented lands in Secs. 9, 11, 15,



Portion of plant of Mineral Products Co., Stanislaus County, California.



Entrance to upper adit, Liberty Manganese Mine, Stanislaus County, California.

21, 22, 27, 28, 33, and 34, T. 6 S., R. 5 E., and began development in 1914. In 1915 the Mineral Products Co., of San Francisco, took over these holdings, part being in Santa Clara County. Production from Stanislaus County began in 1916. Activities increased with the war demand for manganese, and lessees were soon developing deposits,

¹ See page 191, ante.

mainly on lands of the Winship Estate, the Crocker Properties and on the Grummit Ranch. On the Winship Lands mines or prospects were opened up on Secs. 1, 3 and 13, T. 5 S., R. 5 E., and on Secs. 17 and 19, T. 5 S., R. 6 E. Shipments were made by the Manganese Products Co., lessee, from a deposit on Sec. 6 T. 5 S., R. 6 E., a por-



Loading manganese ore on truck, Liberty Manganese Mine, Stanislaus County, California.

tion of the Grummit Ranch. Another deposit has been noted on Sec. 8, T. 6 S., R. 6 E., and slightly prospected.

The most important of the above was the *Buckeye Mine* ¹ of the Winship Estate, in Sec. 3, T. 5 S., R. 5 E., on a branch of Hospital Creek

¹ Bradley, W. W., Manganese production in 1919: Cal. State Min. Bur., Bull. 88, pp. 47-48, 1920; also Bull. 76, pp. 85-87, 1918.

southwest from Vernalis. This mine was one of the largest three producers of the state during 1918-1919, and yielded a total of approximately 14,000 tons during that period of activity. Ore was first mined here in an open-cut stope which revealed an orebody 20' wide and over 75' long carrying 48% Mn; and, later, by means of a shaft and underground stopes. The shaft is over 300' in depth. The ore in the lower workings is mainly carbonate (rhodochrosite). The Suffern Company of New York, lessees in 1918-1919, put in an aerial tramway which transported the ore from the mine to loading bunkers for auto trucks about a half mile down the canyon.

Manganese mining almost ceased when the war emergency ended, and importation of foreign manganese ores was resumed. At the time of

visit (March, 1925) only one mine was active in the county.

Liberty Manganese Mine. This property consists of five claims, located in Sec. 36, T. 4 S., R. 5 E., owned by the Ferro-Manganese Co., 703 Hobart Building, San Francisco; F. E. Hartzell, president; Robt. C. Oliphant, vice president. The company was organized in 1923, but did not get into production until 1924. The deposit is opened up by two tunnels. The upper or main adit is approximately 250 feet long. It is run as a crosscut for about 50 feet and then on the vein, which has been stoped for a width of four to six feet from this level to the surface and understoped in places to a depth of 35 feet. tunnel has been started 105 feet lower as a crosscut. The latter is in approximately 240 feet, but it will have to be run considerably farther to get under the orebody, now being worked in the upper tunnel. The property is equipped with a 40-h.p. Fairbanks-Morse gas engine, 10" x 10" Sullivan compressor, track, cars, and camp buildings. number of men employed varies from three or four to eight or nine, depending on the size of the orebody and other conditions. The ore produced averages about 45% manganese. It is hauled 14 miles by truck to Westley for shipment.

Bibl: State Mining Bur. Bull. 76, pp. 83-87; State Mineralogist's Report XIV, p. 630; U. S. Geol. Survey Bull. 467.

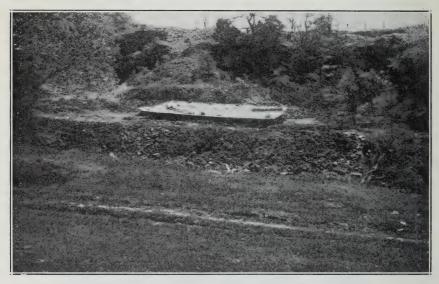
MINERAL PAINT.

Mineral paint material, mainly in the form of yellow ochre, has been mined on a small scale in the vicinity of Knights Ferry for many years. Outcroppings occur in many places on both sides of the river, but only three properties are at present developed to a point where production can be made.

California Ochre Mining Co. Address, 665 Third Street, San Francisco; C. H. Kaul, manager. This property, consisting of 34 acres, is a part of the old Voyle holdings. The above company has owned it for the past 30 years, and has produced a large amount of ochre during that time, though operations have been intermittent, depending on demand. The deposit is located in Sec. 17, T. 1 S., R. 12 E., and consists of a stratum of soft yellow ochre from four to six feet in thickness, in the form of a very flat anticline. It has been opened up by a number of drifts. Mining is usually done by local parties, under contract

Weidman Ranch Deposit. Prowse and Williams, owners, Knights Ferry, California. This deposit is on the south side of the river, directly opposite Knights Ferry. The ochre stratum on this property is from 4 to 6 feet in thickness. About two acres have been worked out. It has been idle for the past 18 months, during which time high water filled the drifts, and caved in much of the workings so that it will be necessary to run a new drift when production is resumed.

Voyle Mine. Owner, V. J. Winkler, Knights Ferry, California. This property is in Sec. 29, T. 1 S., R. 12 E., M. D. M., on the north side of the Stanislaus River at Knights Ferry, thirteen miles by paved highway east of Oakdale, the nearest railroad point. There are 60 acres in one tract on which most of the mining has been done and another tract of 18 acres, undeveloped. The present owner has had the property for 7 years. The deposit consists of a stratum of yellow



California Ochre Mining Company's property, Knights Ferry, Stanislaus County, showing ochre on dump covered with sheet iron.

ochre, varying from 5 to 8 feet in thickness, lying practically horizontal, with clay below. It is opened up by drifts, with pillars left to support the roof. The material varies in hardness, it being quite soft in places, but the workings are dry, and it stands well. Auger drills are used in mining. Operations are intermittent, depending on the demand.

PETROLEUM.

Considerable interest has been taken in the oil possibilities of Stanislaus County, and operators have acquired leases for drilling purposes on both the west side of San Joaquin River and in the vicinity of Oakdale and Knights Ferry. Drilling started as early as 1920, but to date no producing well has been brought in.

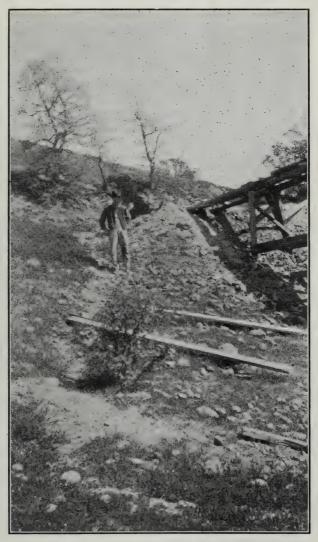
Details relative to the geology and petroleum possibilities are contained in Bulletin 89 of the State Mining Bureau, and all field opera-

tions are reported in current issues of 'Summary of Operations, California Oil Fields,' published monthly by the Department of Petroleum and Gas of the State Mining Bureau.

No attempt was made to cover oil development in the present report. The reader interested in this subject is referred to the above publica-

tions and others listed below, which are devoted to it.

Bibl: State Mining Bur. Bull. 89; U. S. Geol. Survey Bull. 603.



Voyle Ochre Mine, Knights Ferry, Stanislaus County. California.

QUICKSILVER.

A wide belt of Franciscan rocks follows the trend of the Diablo Range from Alameda County southeasterly for many miles. Within this belt in western Stanislaus County there are a number of quicksilver prospects, from some of which the metal has been produced. At the time of visit (March, 1925) none of the properties in the county

were being worked.

The Adobe Valley or Stanislaus Mine consists of 320 acres of patented land in Secs. 23 and 24, T. 6 S., R. 5 E. This mine was opened up in 1884. During the following four years a small amount of quicksilver was produced, since which time it has not been worked. Some work has been done by lessees on a quicksilver prospect in Sec. 31, T. 5 S., R. 5 E., owned by M. I. Crocker and K. D. Winship, of San Francisco. The same lessees also did some development work on the adjoining Newhall or Deer Park Mine, which comprises seven claims on Deer Park Creek in Sec. 32, T. 5 S., R. 5 E., but no metal was produced. The Gigax claims are located near the Newhall. They are undeveloped. The International Mine is in Sec. 3, T. 8 S., R. 6 E., on the south fork of Orestimba Creek, southeast of the Phoenix Mines. Some quicksilver was produced here prior to 1880, but it has been idle The Phoenix Mines includes the former Summit. Gravson, and Orestimba group, also referred to as the Hayward. The Summit-Grayson group is in Secs. 20, 21, 28, and 29, and the Orestimba group in Secs. 25, 35, and 36, all in T. 6 S., R. 5 E., 24 miles southwest from Patterson by a poor road. There is a good road to Livermore, 39 miles distant. There are seven patented claims, four mill sites, six unpatented claims, and 160 acres of timber land in the Summit-Grayson group, and 2300 acres of patented land in the Orestimba. This property was opened up in the 70's and sold to Alvinza Hayward about A 50-ton Scott furnace was built in 1902-3. The mine was re-opened the latter part of 1915 and operated until June, 1916, a period of high quicksilver prices. The ore is low grade and larger equipment and more extensive development are required to handle such ore.

Bibl: State Mineralogist's Reports X, pp. 680, 681; XIII, p. 603;
XIV, pp. 632, 633. State Mining Bur. Bull. 27, pp. 188, 189;
Bull. 78, pp. 197–199. U. S. Geol. Survey Min. Res., 1915, Pt. I,
p. 271.

Orestimba Mining Co. This is an incorporated company, with an authorized capitalization of \$200,000. H. A. Wilder, 217 Tait Avenue, Los Gatos, California, managing director. The company owns a group of 22 claims in Sec. 28, T. 7 S., R. 6 E., about 25 miles south of west of Crows Landing. There is a poor road for 20 miles and then five miles of trail to the mine. The property was equipped during the war period with a 12-pipe retort, and a small production was made under the name of Palo Alto Mining Association. There is a shaft 75 feet deep, which is said to be in high-grade ore at the bottom. Magnesite also occurs on the claims, but it has only been slightly prospected.

SILICA.

There is a deposit of comparatively pure silica in ledge formation on Del Puerto Creek, about 12 miles west of Patterson. The road, which follows the grade of the former Patterson and Western Railroad, passes directly across the end of the formation.

Hammonds Property. Wm. N. Hammonds, of Patterson, has located Silica No. 1 Claim on the ledge, in Sec. 4, T. 6 S., R. 6 E. The ledge outcrops boldly, varying in width from 5 to 20 feet. It is composed essentially of pure white quartz. Two analyses of samples of the material are reported as follows:

(1) by George A. James Co.

Water	0.8%
Iron	None
Silica	99.2%

(2) by Smith, Emery and Co.

Silica	99.783%
Alumina	0.21 %
Iron oxide	0.007%

Only a small amount of development work has been done. Several tons of the material in lump form are piled on a loading platform beside the road. Should the Western Stockton Glass Plant resume operations, it is possible that it could be used by that plant.

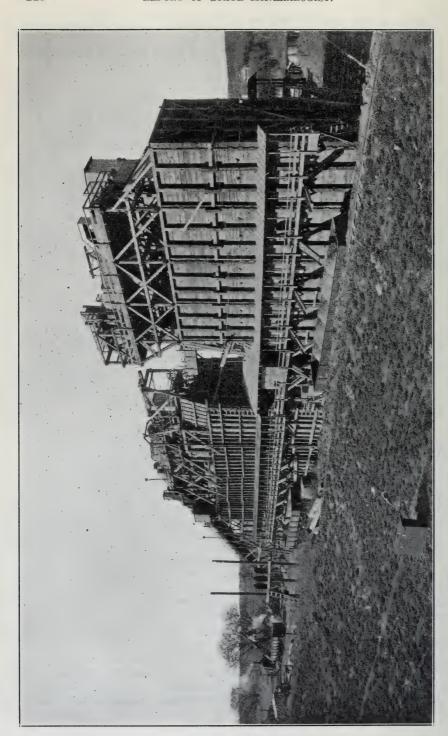
STONE INDUSTRY.

Crushed Rock, Gravel and Sand.

Atlas Rock Co. Alexander McMillan, president; Fred R. Beerman, secretary and manager; home office, 904 Commercial and Savings Bank Building, Stockton, California. The company was organized March 7, 1923, and owns 167 acres, covering the present Stanislaus River and older bench gravel deposits situated three miles east of Oakdale on the line of the Sierra Railway Company connecting with the Santa Fe and Southern Pacific at Oakdale.

A Marion drag-line steam-shovel, type 36, with 1½-yard bucket, excavates the material, which is transported on standard-gauge railroad equipment to the plant. The equipment consists of a 21-ton Vulcan locomotive and one twelve-vard Western wheeled-scraper dump car. The dump car is automatic in all its actions, dumping and locking by means of air operated by the engineer on the locomotive. The time required to dump 25 tons of material in the hopper, measured from the time the locomotive comes to a dead stop, the car dumping its load, righting and locking itself and ready to start back to the steam shovel for another load, is eight seconds.

The material is fed from the bottom of the hopper to a 30-inch belt by means of a steel pan feeder. The belt, which is 251 feet between centers at an angle of 20 degrees, elevates the material to a 60-inch cylindrical screen 24 feet long. The first section of this screen is a scrubber, 6 feet long, having no perforations. Six 4-inch angles, spaced equi-distant and longitudinally in the inside of the scrubber, carry the material up on the inside of the screen, where it is dropped back; the force of the impact against the bottom of the screen loosening the silt and clay from the gravel. The primary washing takes place in this scrubber. Water is furnished by a 5-inch two-stage Byron-Jackson pump, which furnishes 800 gallons per minute under 20 pounds pressure at the nozzle end. A 6-inch cast iron pipe line



Plant of Atlas Rock Co., Oakdale, California. Photo by courtesy of Atlas Rock Co.

carries the water from the river to the scrubber. After it leaves the scrubber, water is sprayed over the material at various points. final rewash is given just before the material is loaded on to the railroad cars for delivery. From the scrubber the material passes to the next section of the screen, which is 14 feet long, with 24-inch perfora-The material which is rejected on this section passes to the next section, which is 6 feet long and has 4-inch perforations. The material which passes through the perforations drops by gravity into the bin, which feeds a 36-inch Symons vertical disc crusher. material rejected by this section drops into the bin which feeds a 14 x 18 inch Farrell jaw crusher. Surrounding the 2\frac{1}{4}-inch perforated section is a 13-inch dust jacket 14 feet long. The material passing through the 2\frac{1}{4}-inch perforated section and rejected by the dust jacket passes into the 2-inch gravel bin. The material passing the 13 inch dust jacket is passed by gravity into two sets of compound Gilbert screens. One of these compound screens consists of an inner conical, having ½-inch perforations and an outer conical having 5-inch perfora-The materials passing through the 13-inch dust jacket and rejected on the inner conical screen drops by gravity into the 1-inch gravel bin. The material passing through the inner conical and rejected by the outer conical drops into the pea gravel bin. material passing through the two outer conical screens passes over two sets of Hungarian gold riffles which remove gold and platinum, leaving the sand, silt, and clay to pass on to two settling tanks, from which the silt and clay is drawn off and sluiced back into the river. One log washer conveys the sand from the bottom of one of the settling tanks into a concrete sand bin; another log washer conveys the sand from the bottom of the other settling tank to a 4 x 6 shaker screen, which produces a fine sand and a coarse sand from \(\frac{1}{8}\) inch to \(\frac{5}{16}\) inch. case it is not desired to produce plaster sand, the sand can be passed direct into the concrete sand bin.

The crushing plant consists of a primary and a secondary crusher as mentioned above. The crushed material from both crushers is fed to a bucket elevator belt, 7" x 11" x 18" buckets with 71-foot centers and is elevated to a 42-inch cylindrical screen. The first section of this screen is six feet long with 7-inch perforations. Around this is a dust jacket six feet long, having 5-inch perforations. Material which passes through the \frac{7}{8}-inch perforations and is rejected on the dust jacket drops into the \(\frac{3}{4}\)-inch crushed rock bin. The material which passes through the dust jacket drops into the dust bin. which are rejected by the \frac{7}{8}-inch perforated section pass on into a section 4½ feet long having 1½-inch perforations. Products passing through this drop into the 1-inch crushed rock bin. The material rejected by this section passes on to a section six feet long having 14-inch perforations. The feed passing through these perforations drops into the 1½-inch crushed rock bin. Rock rejected by this last section passes on to a section six feet long having $2\frac{3}{4}$ -inch perforations, and that passing through these perforations drops into the 2½-inch crushed rock bin. The materials rejected by this last section drop into a small bin which feeds a 20-inch conveyor belt which returns the rock to the bin feeding the Symons disc crusher.

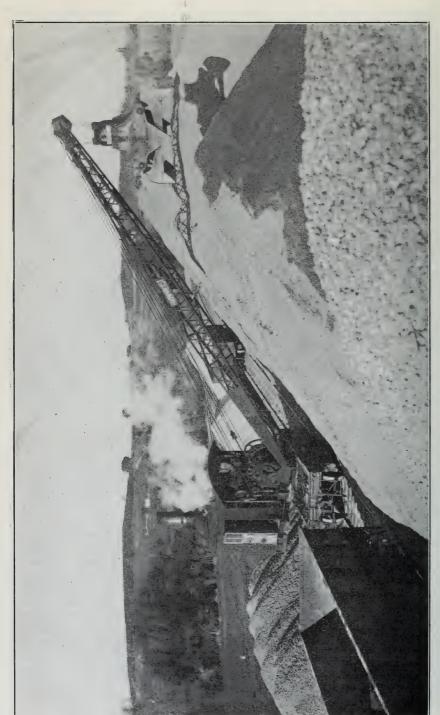


Photo by courtesy of Atlas Rock Co. Portion of stock piles, Atlas Rock Co.,

One of the features of this crushing plant is that any one of the sections of the cylindrical screens can be blanketed. This enables the production of any size crushed rock desired. It also enables the mix-

ing of any one or all of the sizes in any one of the bins.

Another feature of the plant are two 30-inch mixing belts. One of them on the sand and gravel bunkers and the other on the crushed rock bunkers. The material is fed from the bunkers onto these belts by means of rack and pinion gates on the north side of the bunkers. This allows the mixing of two sizes of sand and four sizes of gravel in any desired proportions, or it allows the mixing of any one or all of the five different crushed rock products. The flexibility of the plant is excellent.

The cars are loaded direct from the south side of each bin when only one size of material is required. The time required for loading



Service Bros. Rock and Gravel Plant, Waterford, Stanislaus County, California.

a 50-ton car is about four minutes. The capacity of the bunkers is 1000 tons of crushed rock and 1100 tons of sand, gravel, and cobbles.

The storage is handled by means of a 20-ton Brown hoist having a 50-foot boom and a 1½-yard bucket. The switching and moving of cars from the plant to the storage ground is performed by a 7-ton Plymouth gasoline locomotive. This has been found to be cheaper than using the locomotive crane, as the fuel consumed by the Plymouth, switching and moving cars for eight hours amounts to only ten gallons of gasoline.

The crane, steam shovel and Vulcan locomotive are equipped with oil burners. The Pacific Gas and Electric Company furnishes electric power to two Westinghouse and four General Electric motors, totaling 265 horsepower. The capacity is 1000 tons per day. Ffteen men

are normally employed. N. F. Jones is plant superintendent.

County Pit. The county operates a small rock crushing and gravel screening plant on the La Grange Dredging Company's property, purchasing the dredger tailings, and utilizing the output on county work.

Service Bros. Pit. Service Bros., address, Ceres, or Waterford, California, are owners of a crushed rock, gravel, and sand plant, located at Waterford, on the Tuolumne River, 14 miles east of Modesto by paved highway. The material is excavated with a Sauerman 1½-yard drag-line bucket, and dumped at the top of the plant. It passes through a revolving screen with 1½-inch holes, the oversize going to an Austin gyratory crusher. The crushed material passes over a dry screen, the oversize from this screen going to a Wheeler jaw crusher in closed circuit. Water for washing is obtained from an artesian well and pumped to the plant by a 3-inch centrifugal pump. There are seven bunkers from which trucks are loaded, and a railroad loading platform is located at Hickman, a station on the Southern Paeific, Oakdale branch, 1 mile distant. Electric power is used, 120 horse-power being required. Three men are employed at the plant. It has a maximum capacity of 700 tons in three 8-hours shifts.



LOS ANGELES FIELD DIVISION.

W. B. TUCKER, Mining Engineer.

VENTURA COUNTY.

General Description.

Ventura County, created March 22, 1872, is one of the coast counties and lies between parallels 34° and 34° 50′ north latitude, having a coastline of about 50 miles. It is bounded on the north by Kern County, on the east by Los Angeles County, on the south by Los Angeles County and the Pacific Ocean, and on the west by Santa Barbara County. The total area is 1878 square miles. The population as shown by the census of 1920 was 28,724, and is now estimated at over 30,000.

The city of Ventura, originally called San Buenaventura, is the county seat, and is located on the shores of the Santa Barbara Channel. The cities of Oxnard, Santa Paula, and Fillmore are next in importance.

Ventura County is essentially an agricultural and stock-raising county. The increasing production of petroleum in the past few years, however, is rapidly bringing it forward on the list of mineral-producing counties.

Topography.

The northern portion of this county is characterized by the convergence of several important mountain ranges which make of it a high and rugged region. The more mountainous and rugged parts of Pine Mountain and Topatopa Mountain form what is considered one of the roughest and most inaccessible regions in California. Its lofty peaks range in elevation from 6000 to 9000 feet, the most prominent of which are Mount Pinos, elevation 8826 feet; Mount Frazer, 8026 feet; Pine Mountain, 7488 feet; and Alamo Mountain, 7371 feet. To the northwest extend the San Emigdio Mountains which form the connection between the Coast Range and the Sierra Nevada Mountains. To the west extend the San Rafael Mountains, while farther southward the Santa Ynez Mountains diverge from this group, running westward through Santa Barbara County.

The southern part of the county is characterized by a series of parallel folds, the axes of which lie east and west, forming low moun-

tain ranges of no great continuity.

The principal valleys are Santa Clara, Ojai, Simi, and Las Posas.

The Santa Clara is a flat river wash, the level floor of which ranges in width from a mile at Piru to over five miles at Saticoy, where it opens out into the wide Oxnard terrace. It is bounded on the north by Sulphur Mountain and the more rugged mountains to the east that form the divide between it and the San Joaquin Valley. On the south it is bounded by the Santa Susana, Oak Ridge, and South Mountains.

The Ojai Valley lies north of the Santa Clara Valley and is separated from it by Sulphur Mountain. A low ridge across its length divides the valley into two parts, called Upper Ojai Valley and Lower Ojai Valley. The lower valley is drained by San Antonio Creek, which flows westward into the Ventura River, while the upper valley is drained by Sisar Creek, a tributary of the Santa Clara River.

Simi Valley lies between the Oak Ridge Mountains on the north, and the Simi Hills on the south.

Las Posas Valley is a continuation of the same drainage basin, and westward joins the Santa Clara Valley, where it opens into the wide marine terrace.

Streams.

The two principal drainage systems of the county are the Santa Clara River and the Ventura River. Next in importance, but subordinate to these is Caleguas Creek, which drains the Simi and Las Posas valleys.

The Santa Clara River rises in Los Angeles County and flows westward 75 miles, emptying into the ocean south of the city of Ventura. Its principal tributaries from east to west are the Castac, Piru, Sespe, and Santa Paula creeks, all of which flow from the north. This stream



Outcrops of Coldwater Sandstone and Shale, Sespe Canyon, Ventura County.

runs almost dry in the summer, but in the winter becomes flooded, often doing great damage in the valley.

The Ventura River receives its principal water supply from Matilija Creek, which rises on the southern slopes of Pine Mountain, and flows southward, entering the ocean at the city of Ventura. This river carries sufficient water throughout the year for irrigation purposes and to supply the city of Ventura.

Climate.

The climate in the southern portion of the county is delightful throughout the year, the summer heat being tempered by cool ocean breezes. Farther east in the valleys it becomes very hot during the dry season. The mountainous region in the northern portion of the county receives a coating of snow in the winter. The rainfall is confined to the winter and spring months.

Transportation.

The county is traversed by the Southern Pacific Railroad, with a branch line from Ventura to Ojai. At Montalvo, five miles east of Ventura, the main line divides into two branches, one going to Los Angeles via Las Posas and Simi valleys, the other through the Santa Clara Valley, joining the San Joaquin Valley line at Saugus.

With the exception of the higher mountainous areas, the county is easily accessible by roads, the main arteries being paved. Access to the gold and borax districts is obtained over the State Highway from

Bakersfield to Los Angeles via Tejon Pass.

VENTURA COUNTY

Year	Gold,	Petr	oleum	Natu	ral gas		alt and nous brick	Brick		
	value	Barrels	Value	M. Cu. Ft	. Value	Tons	Value	M.	Value	
1880		(2)								
1881										
1882 1883										
1884										
1885										
1886										
1887										
1888										
1889 1890										
1891										
892										
1893										
894		290,913	\$367,822			248	\$4 800			
895		244,624	244,624				3,500			
896		248,000 368,282	272,800 368,282							
898		427,000	571.000			4,105	80,775	286	\$2,228	
899		496.200	496,200			5,188	103,760	375	3,000	
900	2,562	443,000	398,700			1,466	31,670	230	1,700	
901	4,183	472,057	236,028			2,073	30,945			
902	,	475,000	455,000			37	370			
903		542,902	517,611			1,114	13,368	1,380	12,900	
904		518,000	465,€82	1,80)	\$2,700	3,169	38,028			
905		375,522	236,578	3,831	5,000	3,000	30,000	1,300	10,400	
906	(3)	311,000 352,224	155,500	3,500	1,000 2,278	3,700	37,000	1,675	11,650 12,800	
907		289 625	211,334 217,219	1,825 3,625	4.531			1,600 200	12,800	
909		344.419	223.872	1.721	2,151			1,275	7.62	
910		492,147	319,898	545	681			1,190	36,94	
911		499,082	349,777	429,580	2,958			900	5,100	
912		662,300	584,811	55,068	4,163			550	3,578	
913		899,007 943,929	907,997 991.125	62,200 100.000	6,220 6,000			1,023 449	6,088 3,102	
915		1.017.220	869,723	491,879	29,670			200	2,500	
916		943,499	985,956	806.540	133,867			(3)	2,000	
917		996,501	1,313,388	1,033,564	152,550			(3)		
918		1,339,342	1,982,226	858,457	150,885					
919		1,685,073	2,755,094	1,038,574	252,240			(3)		
920		1,989,681	4,988,130	1,521,448	214,280					
921		2,167,326	5,869,119	2,127,476	360,443			(3)		
922		2,933,685	5,236,628	3,583,818	536,502					
923		3,610,794	4,109,084	4,162,318	470,261					
Totals	\$22,871	26,378,354	\$36,701,208	15,887,769	\$2,338,380	24,275	\$374,216	312,633	\$121,110	

^{*}Includes crushed rock, rubble, sand, gravel.

*Commercial production of petroleum in Ventura County began at least as early as 1874, in the Sulphur Mountain district, but detailed county segregations are not available for the early years.

*See under 'Unapportioned.'

*Quantity estimated, as only values given in reports of those years.

MINERAL PRODUCTION, 1880-1923.

Pottery clay San		Sands	Sandstone Miscellaneous		Miscellaneous and unapportioned					
Tons	Value	Cubic feet	Value	stone ¹ , value	Amount	Value	Substance			
					~~~~~~~~					
		16,200	\$16,500							
		33,200	20,000							
		00,200	20,000							
					250 tons	\$6,590	Borax.			
		12,500	6,250	\$35,279						
		4,200	2,650	16,764	3,000 tons	60,000	Borax.			
					(	4	Silver.			
		3,200	1,600	22,500	50 tons	2,500	Mica.			
		1,750	900	25,100	3,500 tons	140,000	Borax.			
		6.000		31.227	50 tons	3,800	Mica. Mica.			
30	\$45	0,000	3,500 1,380	60,490	ou tons	3,000	wica.			
30	949	2,300 1,320	792	00,490						
		1,520	194	20,880						
560	1,680			15 406						
000	1,000			144 226		830,853	Unapportioned, 1900-1909.			
		900	450	15,406 144,226 35,000		000,000				
1,900	1,900	4,658	2,325	750						
1,000	1,000	4,600	1,850							
3,000	2,990	300	150			1,530	Unapportioned.			
		1,195	502				0.1			
				2,674		200	Other minerals.			
(3)		(3)		14,200		1,407	Brick, clay, sandstone. Brick and sandstone.			
(0)				30,000		2,072 300	Other minerals.			
		(3)		52,900		4,500	Clay and clay products.			
(3)		(3)		5,000		190	Other minerals.			
(3)		(3)		25,265		500	Mineral paint and sandstone.			
( )						3,985	Clay and clay products.			
				11,250		472	Mineral paint and sandstone.			
				62,888		1,060	Mineral paint and sandstone.			
				88,211		12,128	Mineral paint and sandstone.			
-0.40										
36,490	\$7,615	392,323	\$58,849	\$701,010		\$1,075,001				

# General Geology.

The rocks of the Ventura region fall into three classes: A metamorphic and granitic complex, which is commonly referred to as the 'basement complex,' a series of sedimentary rocks, and a series of igneous extrusive and intrusive rocks.

The metamorphic rocks are all of pre-Jurassic age and have been intruded by granite that is probably of the same age as that of the Sierra Nevadas, which is considered to be late Jurassic or early Cretaceous.

The sedimentary rocks, which in this region form the greater per-

centage, range in age from Upper Cretaceous to Recent.

The igneous rocks are practically all of the Miocene age and are mainly andesite, dacite, basalt, andesite breccia, and associated mud flows.

### Mineral Resources.

Ventura County is the eighth county in the state in respect to the value of its mineral production for the year 1923, the exact figures being \$4,679,684. The value of natural gas and petroleum amounted to \$4,579,345; the remainder of the production amounting to \$100,339 was from clay, crushed rock and gravel, mineral paint, and sandstone. The State Mining Bureau records of mineral production of the county date from 1880. Considerable gold was produced in the county previous to 1880, but of this there is no record. The production of borax from the time of its discovery in this county in 1898 to 1907 amounted to over 35,000 tons, valued at over \$1,000,000.1

Among its other mineral resources are: Asphalt, borax, clay, diatomaceous earth, gypsum, limestone, mineral water, mineral paint, molding sand, phosphates, and sandstone.



¹ Gale, H. S., Borate Deposits in Ventura County, Cal.; U. S. Geol. Surv. Bull. 540, p. 434, 1912.

## METALS.

GOLD.

The gold deposits of Ventura County are confined to the high mountainous region in the northeastern portion of the county embracing Mount Frazer on the north and McDonald Peak on the south, and known as the Piru District. The gold occurs in fissure veins in the mountains, which are composed largely of granite, syenite, schist, and slate, and in the gravels of the Piru drainage basin. It is said that the first gold discovered in California was that found in the placers of this district in 1841 by Andres Castillero. In 1842 gold was shipped from the placers to the United States Mint at Philadelphia.¹

The deposits of gravel extend along the north side of Piru River from about 2½ miles above the mouth of Lockwood Creek to its head. and also in San Quelmo Canyon, a tributary of Lockwood Creek. Sluicing and rocking have been carried on intermittently here for many years. The gold is coarse and not much worn. The gravels lie in the form of terraces, extending in places to the top of the hills between Piru River and Lockwood Creek. These gravels were probably deposited by a Pliocene river heading more toward Mount Pinos than the present Piru.

Underneath the gold-bearing gravels is an older deposit of a different character, and barren of gold. It is more firmly cemented and perhaps belongs to the Miocene, which is strongly developed in this section.

In a similar manner, gravels overlie the Tertiary on the flanks of Frazer Mountain and Mount Pinos. On the former mountain they are gold-bearing. In later years a number of attempts have been made to work the gravels and some production is reported to have been made. The principal mining development in recent years has been confined to the quartz veins in the Piru and Snowy Mining Districts.

This region suffered from the disadvantage of being over fifty miles from the main lines of transportation. The State Highway from Bakersfield to Los Angeles via Tejon Pass makes the district much more accessible; also the recent development of Lockwood Valley will insure better roads for automobile travel, and should greatly aid in its devel-

opment.

Arastra Flat Group of Claims. The group comprises two claims, Arasta Flat and Max B., located in the Piru Mining District south of the Frazer Mine. The vein strikes northwest and southeast, and is probably on the same lode as the Frazer Mine. Workings consist of several tunnels and opencuts. D. W. Maxy of Gorman, owner.

Big Four Group of Claims comprises three claims; Big Four, Hornet, and Lookout, located in the Piru Mining District, on the southern slope of Frazer Mountain. F. W. Spring of Ventura, owner.

Blue Bell Group of Claims. This group, comprising four claims known as Blue Bell, Red Bell, Silver Bell, and Yellow Bell, is located on Fitzgerald Mountain, 13 miles southeast of Lockwood Valley, and one-half mile from Long Dove Creek. The course of the vein is north and south. The country rock is syenite and granite. Workings consist

¹ See Hittell's History of California, Vol. 11, p. 313.

of tunnels and opencuts. Owners, C. H. Crandall and Dr. W. R. Colbert of Gorman.

Castac Mine is located on the ridge south of Piru River in the Snowy Mining District, about ten miles south of Gorman. Elevation is 4000 feet.

The property comprises three patented claims and two quartz claims held by location in Sec. 22, T. 7 N., R. 19 W., S. B. B. and M. Owners, Castae Mining Company; Chas. M. Dobson, president; A. B. Brant, secretary. Offices, 214 Citizens Bank Building, Pasadena, California.

The outcrop of the Castac vein can be followed for over 10,000 feet on the surface. The vein has a general northwest strike, and dips about 25° to the northeast. The width of the vein varies from two to four feet.

The country rock is granite and hornblende schist. The hanging wall

of the vein is hornblende schist, and the footwall is granite.

The main tunnel is 600 feet above the river, and about 75 feet below the outcrop. The tunnel is driven S. 60° E. on the vein, a distance of 250 feet. Here the vein was cut off by a fault which strikes N. 50° E., and dips 60° NW. A drift was driven approximately 400 feet northeast on the fault, where the vein was encountered, and a drift run about 400 feet southeast on the vein. The vein has an average width of three feet. At 300 feet an ore shoot was encountered, which is said to have produced \$35,000 in gold. It is said that 9000 tons of ore valued at \$125,000 was milled from this level. Total amount of drifting and crosscutting on this level is 1000 feet. At 60 feet vertically below this tunnel is another tunnel with 1200 feet of underground workings. The ore developed is said to average \$14.00 per ton. The quartz is free milling, with some iron pyrite.

An aerial tramway runs from the lower tunnel to the 5-stamp mill

on Piru River. The mill was driven by water power. Idle.

Bibl: State Mineralogist Reports VIII, p. 683; XII, p. 315; XIII, p. 497; XV, pp. 759-760.

Contact Mine comprises three claims located on Fitzgerald Mountain, in Secs. 34 and 35, T. 8 N., R. 20 W., S. B. B. and M., six miles southwest of Stauffer. Elevation 6000 feet. Owners, Thomas and Richard Harris of Ventura.

The vein strikes north and dips 40° west, varying in width from a few inches to four feet. It is said to average 14 inches. It has syenite

for a footwall, with a porphyry hanging wall.

The workings consist of three tunnels driven along the vein at different levels and connected by winzes. The main working tunnel is 1000 feet in length. The greatest vertical depth of the vein exposed below the outcrop is 700 feet. The property is being developed by the owners during the summer months.

Bibl: State Mineralogist's Report XV, p. 760.

Esperanza (Foley) Mine is on the western slope of Frazer Mountain, at an elevation of 7000 feet. Holdings comprise three claims. Owners, Chas. Seifert and Mrs. Elizabeth Seifert of Los Angeles. Under option to P. J. McLaughlin of Los Angeles.

Three parallel veins varying in width from a few inches to four feet occur in the granite. These strike N. 30° E., and dip 65° E. Workings consist of three shafts about 75 feet deep sunk on the different veins, and a tunnel 125 feet in length, which is being driven to connect with one of the shafts. The ore is free milling quartz with some pyrite and chalcopyrite. Equipment consists of a Western Engineering Company's mill. Two men are employed.

Bibl: State Mineralogist's Reports VIII, p. 682; XIII, p. 497; XV, p. 760.

Frazer Mine, located in 1867, was the first quartz mine worked in the Piru District. The property comprises two claims known as Frazer No. 1 and Frazer No. 2, and is located in Sec. 13, T. 8 N., R. 20 W., S. B. B. and M., on the southern slope of Frazer Mountain, at an elevation of 6500 feet. Owner, Miss Nannie Bicknell. Dr. C. P. Baggs, agent, Bradbury Building, Los Angeles.

The vein strikes northwest and is nearly vertical. The country rock is porphyry, gneiss, and talcose slate. The vein quartz is free milling, and contains a percentage of pyrite and chalcopyrite. The average value of the ore is said to have been from \$15.00 to \$18.00 per

ton in gold.

Workings consist of seven tunnels driven on the vein at different elevations. These tunnels are from 40 to 500 feet in length. Total

amount of underground workings is over 3000 feet.

In 1893 the mine was sold to the Frazer Mining Company of Los Angeles and operated until 1895, when operations were suspended, and have not since been resumed. This mine has been the largest producer in Ventura County. Reported production, \$1,000,000.

Bibl: State Mineralogist Reports VIII, p. 682; XII, p. 315; XIII, p. 497; XV, p. 760.

Golden Bloom Group of Claims comprises three claims known as Golden Bloom, Lead Bloom, Crooked S., located in Piru District on Fitzgerald Mountain, about one mile south of the Contact Mine. Workings consist of short tunnels and opencuts. Owner, R. H. Colbert of Gorman.

Oro Fino Mine comprises two claims known as Oro Fino and Golden Era, located in the Piru Mining District south of Frazer mine. The vein strikes northwest and southeast. The average width is six inches. The country rock is granite. Workings consist of a shaft and short tunnels. Idle. Owners, A. F. Maxy and Chas. Maxy of Gorman.

Patton Mine is located in San Emigdio in the Piru Mining District. Workings are superficial. Owners, L. M. Patton, A. C. Patton, and Harvey Simpson of Ventura.

Red Rock Group of Claims comprises two claims known as Red Rock and Oak, which adjoin the Castac mine on the southeast. The claims are located in Sec. 22, T. 7 N., R. 19 W., S. B. B. and M., on the ridge between Piru River and Snowy Creek, eight miles north of Gorman. Elevation 4500 feet. Owner, William Snyder of Gorman.

The vein, which has an average width of three feet, is a continuation of the Castac vein. It strikes northwest, and dips 45° northeast.

Samples taken from different points along the outcrop are stated to

have averaged \$15.00 in gold. The country rock is schist.

Workings consist of a tunnel driven southeast 125 feet in the hanging wall of the vein, and a number of opencuts along the vein. One man is employed.

White Mule Group of Mines is on the western slope of Frazer Mountain, at an elevation of 6000 feet. The property includes the Bunker Hill and Fair View mines. Owner, Fred M. Wilcox, 328 O. T. Johnson Building, Los Angeles.

The vein strikes east and has a dip of 45° to the north. The average width of the vein is three feet. The quartz is heavily mineralized with

pyrite, marcasite, and chalcopyrite.

On the White Mule Claim is an incline shaft 320 feet on the vein, and in a gulch south of this shaft, a crosscut tunnel has been driven 300 feet N. 20° E. with the intention of intersecting the shaft to drain the mine workings. The vein in the Bunker Hill claim was developed by tunnels and opencuts, most of which are caved.

Equipment consists of a gasoline hoist, pumps, and a blacksmith

shop. Idle.

Bibl: State Mineralogist's Reports VIII, p. 682; XII, p. 316; XIII, p. 497; XV, p. 760.

#### MOLYBDENITE.

Small kidney-like deposits of molybdenite associated with copper ores ocur on Frazer Mountain and on McDonald Peak. James McDonald of Ventura has done some development work on a deposit located near the headwaters of Alder Creek, in the Snowy Mining District. Five claims have been located in Secs. 11 and 12, T. 6 N., R. 19 W. The country rock is granite.

### PLATINUM.

Platinum is said to occur in the black sands of Lockwood Creek, but it is probably not present in commercial quantity.

#### NON-METALLIC MINERALS.

# Asphalt and Bituminous Rock.

Extensive deposits of natural asphalt and bituminous rock are located in Brea Canyon, Cañon Del Diablo, Upper Ojai Valley, and Punta Gorda. The manufacture of asphalt by refining from crude petroleum has entirely replaced its production from the natural asphalt and bituminous rock deposits, and no work has been done on the various deposits for years.

Brea Canyon Mine is on the Cañada Larga Ranch, five miles north of Ventura. W. R. Welden of Ventura, owner. Narrow veins of bituminous rock are irregularly distributed over an area of 200 acres.

Bibl: State Mineralogist's Reports XIII, p. 44; XV, p. 754. Bull. No. 11, p. 48.

Cañon Del Diablo Mine is five miles northwest of Ventura on the Cañada de San Miguelito Ranch. The Taylor Estate, Ventura, owner.

A detailed report of this mine is given by Prof. E. W. Hilgard in the Tenth Annual Report of the State Mineralogist.

Bibl: State Mineralogist's Reports X, p. 763; XIII, p. 44; XV,

Ojai Mine is in Secs. 3 and 10, T. 4 N., R. 22 W., S. B. and M., three miles west of Ojai in the Upper Ojai Valley. It is a deposit of decomposed sandstone and shales impregnated with heavy viscous bitumen which is seeping out of the bituminous shales. Undeveloped. Owners, J. S. Briggs and F. W. Ewing of Ventura.

Bibl: State Mineralogist's Reports XIII, p. 45; XV, p. 754. U. S. Geol. Surv., Twenty-second Annual Report, part I, p. 446.

Punta Gorda Mine, one-fourth mile north of the Southern Pacific Railroad at Punta Gorda, is in Sec. 1, T. 4 N., R. 25 W., S. B. B. and M. Asphaltum occurs in irregular veins in bituminous shales and clays which strike east, dipping steeply to the north. Owners, Henry D. Abbott and Thomas Gaynor of Punta Gorda.

Bibl: State Mineralogist's Reports XII, p. 33; XIII, p. 45. U. S. Geol. Surv., Twenty-second Annual Report, Part I, pp. 445-446.

Rincon Mine, one and one-half miles northeast of Punta Gorda, is a small deposit of bituminous sand. The mine has not been worked to any extent.

Bibl: State Mineralogist's Reports XII, p. 33; XIII, p. 45; XV, p. 754.

#### BORAX.

Colemanite, a borate of lime, was first found in Ventura County in 1898. The deposits are confined to a narrow belt along the eastern slope of Mount Pinos, in the extreme northeast corner of the county, and are classed among the few important borax deposits of the United States.

Three important mines have been developed in the district, and a considerable number of other holdings have been worked. These mines lie in the foothills, at the northern margin of Lockwood Valley, at the headwaters of Piru Creek. They are known as Columbus, Russell, and Frazier Mines. The mines are at present inactive, mainly on account of their distance from railroad transportation, and the development by the Pacific Coast Borax Company of large deposits near Ryan, Inyo County, which are more favorably situated in this respect.

The colemanite deposits occur within a series of bedded rock formations that have been extensively folded and faulted. In general, the trend of the outcrop is northeast, and the beds dip southeastward, away from the higher elevations in the Mount Pinos Range. The ore has not been found to any extent in outcrops on the surface.

Quoting Mr. Hoyt S. Gale, who made a detailed report on these deposits in Bulletin 540, U. S. Geol. Surv:

"The borate-bearing beds lie in the sedimentary rocks closely associated with the basalt lava flows * * * *

"Massive ledges of limestone occur within these shale zones, particularly at the Frazier, Russell, and Columbus properties, and appear to be intimately associated with the principal ore bodies. * * *

"The colemanite of the deposits of Ventura County occurs in roughly lenticular bodies which are extremely irregular in outline. The greater part of the ore is massive and crystalline, ranging from the transparent glassy crystals occurring here and there to milky-white masses. Most of the deposits are dark-gray to blackish color, probably owing to included impurities. In general the material would be described as a gray ore * * *

"The gangue of the colemanite ore in Ventura County is chiefly shale, with some limestone. The limestone is believed to be directly associated with the larger ore bodies. * * *

limestone. The limestone is believed to be directly associated with the larger ore bodies. * * *

"The outcrop of the colemanite ore-bearing zones may be distinctly traced at least for a certain distance at the Frazier, Russell, and Columbus mines, and as these are the only occurrences of proved ore in depth * * *

"The chief characteristics of the outcrops seem to be the occurrence of gypsum, in stringer form, mainly interlaminated in the bedding of the fissile and crumpled shales, as a rule closely associated with beds of basaltic lava and in the principal ore bodies with ledges of massive travertine-like limestone. A characteristic of the associated shales that is conspicuous in some of the outcrops is the occurrence of small rounded calcareous concretions or 'buttons' * * * ""

Columbus Mine comprises one patented claim of 160 acres, and ten unpatented claims located in Sec. 14, T. 8 N., R. 21 W., S. B. B. and M. The mine is the most northeasterly of the three developed mines of this



Gypsiferous Shales Containing Colemanite. Stauffer, Ventura County.

district. The property was located in 1899 and operated continuously from 1902 to 1907. Sold to the National Borax Company in 1912.

This company erected bins and a sorting plant; also a rotary roaster six feet in diameter by sixty feet in length, jaw crusher, and screens were installed. Crude oil was used as fuel. Shut down in 1913 and has since been idle. Owner, United States Borax Company of West Virginia; C. B. Zabriskie, president.

Workings consist of a vertical shaft and numerous tunnels, all of

which are caved.

The orebody is associated with massive limestone which outcrops in the gulch just above the mine. This ledge strikes northeast and stands nearly vertical. Production from this property began in 1902, and it is reported to have produced 9000 tons of crude ore up to 1907, after which the property was shut down. Practically all equipment has been junked and is being sold. Only assessment work is being done on the unpatented claims.

Bibl: U. S. Geol. Surv. Bull. 540, p. 448.

Frazier Mine is situated about midway between Seymour and Bitter creeks, being located southwest of the Russell Mine. It comprises twenty patented claims. Owned by the United States Borax Company;

C. B. Zabriskie, president.

This mine was the first property located for borax in the district and has the most extensive underground development. The first locations were filed in 1898, and the work developed was undertaken soon afterwards. The mine first reported production in 1899, and was a producer until 1907, when operations were suspended. It is estimated that the total amount of crude ore shipped from this property has been about 25,000 tons.

The main workings are confined to Sec. 14, T. 8 N., R. 21 W., S. B. B. and M. The orebody was worked by a number of tunnels, the main one being 1700 feet long. These are driven along the course of the vein. The outcrop of the ore-bearing zone is represented by a thick-



Russell Borate Mine. Stauffer, Ventura County.

ness of 40 feet or more of thin bedded gypsiferous shale, which includes a ledge of fractured limestone some 12 feet thick. The orebodies are lenticular, often averaging 14 feet in width. The ore consists chiefly of whitish or grayish crystalline material which is a massive colemanite. All equipment on the property has been dismantled and sold.

Bibl: U. S. Geol. Surv. Bull. 540, p. 443.

Russell Mine lies between the Columbus and Frazier Mines, in Seymour Canyon, and comprises 200 acres near the middle of Sec. 14, T. 8 N., R. 21 W., S. B. B. and M. Owned by the Russell Borate

Mining Company, 624 California Street, San Francisco.

The workings consist of the main shaft 200 feet deep, with levels at 50′, 100′, and 200′. The 200-foot level is the main working level. It is 450 feet long running N. 16° W., and strikes the orebody at 319 feet. The ore developed on this level strikes N. 75° W., and dips 60° S. It has been developed on three sides by drifts. A winze was sunk

from the 200-foot level and is said to be in ore to a depth of 50 feet. The orebody in the mine is included in a section of shale and lime-stone interbedded in the basaltic flow rocks, the whole series having about a dip of 60° S. The orebodies are very irregularly distributed in the ore-bearing zone. The ore consists of glassy crystalline colemanite, mostly massive, varying from white to black in color, and is so mingled with limestone that it varies from nearly pure colemanite to limestone masses containing blotches of colemanite.

Equipment consists of 25-ton borax drying furnace, sorting bins, compressor, blacksmith shop, store, and other buildings. This is the only mine at which the equipment is kept in good condition. Idle.

Bibl: U. S. Geol. Surv. Bull. 540, p. 445.

Other Deposits and Prospects: Considerable prospecting has been done, and a great many claims have been located along the gypsiferous shales interestratified with basaltic lava flows that are exposed in the lower part of the canyon of Bitter Creek, west of the Frazier mine. It is reported that some ore was mined and shipped from this area. All workings are caved.

The borate-bearing beds which are exposed on the south side of Cuddy Canyon, at the foot of Frazer Mountain in Secs. 34 and 35, T. 9 N., R. 20 W., in Kern County, extend southwestward through Seymour Creek, Bitter Creek, and west of the North Fork of Lockwood Creek. A large number of locations have been made along this belt, and considerable prospecting has been done.

The shales are again exposed in the Upper Valley of Seymour Creek above Russell mine. A considerable amount of development work has

been done in this area, but no ore developed.

In the past a number of prospect tunnels were driven along an outcrop of the gypsiferous shales on the Middle Fork of Lockwood Creek, and it is stated that several cars of colemanite were shipped

from this point.

Some prospecting has been done for borate ores on the canyon of the North Fork of Lockwood Creek. It is stated that 160 tons of ore were shipped from a deposit on the west side of the creek. The prospects along this creek are in gypsiferous shales underlying the lava flows. These shales and lava flows outcrop westward from the North Fork for a considerable distance, probably as far as Dry Canyon.

#### CLAYS.

The clay deposits of Ventura County are mostly low-grade clays which include the adobe clays, common red brick and tile clays, and shales. The adobe clays are extremely strong plastic clays that slake readily when wet to a very sticky, pasty mass, and become hard on drying. A supply of fairly good clay and gray and blue shale is found at a number of points in Ventura County.

A low rounded hill located northwest of Montalvo Station, and west of the Los Angeles-Ventura Highway, contains beds of red vitrified clay. This clay is suitable for the manufacture of vitrified brick.

On the southwestern slope of Sulphur Mountain, west of Santa Paula Creek are beds of blue and gray plastic shale with an overburden of adobe that is suitable for the manufacture of common red brick and building tile. These deposits are being developed three miles north of

the city of Santa Paula, on the Santa Paula-Ojai road.

Extensive beds of yellow and blue plastic shale are found in the hills east of the Ventura River, about two miles north of the city of Ventura. These beds of shale have been proved by drilling and excavating operations that show they extend north of the city limits of Ventura to Cañada de San Joaquin. Where these deposits are being developed the hill rises above the floor of the valley to an elevation of 500 feet. The clays are suitable for the manufacture of common red brick, roofing, building and drain tile.

An extensive belt of diatomaceous shale, which has a general strike to the northwest, is exposed on the Ventura-Ojai road between Cañada Larga Canyon and San Antonio Creek. These deposits may prove of commercial importance for the manufacture of light insulating brick.

Deposits of montmorillonite occur in a belt of diatomaceous shales on the Ventura-Ojai road five to nine miles north of Ventura. Montmorillonite is a clay-like variety of kaolin, containing a great amount of combined water. It is a form of halloysite, hydrous silicate of alumina. The material is quite soft, is white, gray, and red, has a soapy feel, and disintegrates when exposed to air. It is of commercial value for cleaning compound, softening of water, as a paint filler, and is used in the oil refineries as a purifier of oils.

#### BRICK AND TILE.

Only two producers of brick and tile are operating in the county.

Anderson & Hardison Pressed Brick Company; J. C. Hardison, president; G. A. Anderson, secretary, Santa Paula. The plant is three miles north of Santa Paula, on the Santa Paula-Ojai road. The clay used is a gray plastic shale, which is hauled from a hill west of Santa Paula Creek by a Fordson tractor and scraper.

The material from the storage hopper is elevated by a bucket elevator to a pulverizer, and is then passed over a 12-mesh incline screen. The minus 12-mesh material goes to the mixer; the oversize is returned to the pulverizer. From the mixer the material goes to a Berg Brick Press. From the press the bricks are loaded on hand trucks and transported to the yard, where they are burned in open kilns. Natural gas is used for fuel. The capacity of the plant is 15,000 brick per day. Ten men are employed.

Peoples Lumber Company, Ventura; J. M. Sharp, manager, has installed a new brick and tile plant two miles north of Ventura. The deposit being worked is a yellow and blue plastic shale, and is located in the hills east of the Ventura River. The Ventura Excavating Company delivers this clay from the clay bank where it is loaded into trucks by means of steam shovels and hauled a short distance, then dumped through a chute into a storage bin. The material from the bins is conveyed to a Potts disintegrator and rolls. From the rolls the ground product is elevated by bucket elevator to a piano wire screen. Through-size goes to a storage bin, oversize being returned to the rolls. From the bin the material is fed by automatic feeder to the pug-mill, and then it goes to the clay auger machine. From the clay auger machine the material passes to a revolving wire-cutting

machine. Brick and tile is then transported to drying sheds, where

they are dried by hot air.

The plant has a capacity of 20,000 brick and 25,000 tile per day. The brick and tile are burned in open kilns. Natural gas is used as fuel. The company manufactures common red brick, building and drain tile, and roofing tile. When operating to capacity fifteen men are employed.

Ventura Excavating Company, H. Love and J. McDonald, Ventura. The company is operating a clay bank two miles north of Ventura, on the hill east of the Ventura River. The deposit is a blue plastic shale, which has been opened up for a distance of about 500 feet. Two steam shovels are being operated, and the company, besides furnishing clay to the Peoples Lumber Company's brick plant, also sells the clay to oil companies operating in the Ventura field. The clay is being used for mud fluid in the drilling of the oil wells in the Ventura field.



Beds of Diatomaceous Earth, South Mountain, Ventura County.

Equipment consists of two steam shovels and four trucks. Ten men are employed.

#### DIATOMACEOUS EARTH.

South Mountain Deposit. Thinly laminated beds of yellowish white diatomaceous earth outcrop along the south slope of the mountain at an elevation of 2000 feet. These beds strike east and dip 60° N. Six placer mine locations consisting of 800 acres have been made along the exposures which are located in Secs. 19 and 20, T. 3 N., R. 20 W., and Sec. 24, T. 3 N., R. 21 W. Joshua Stockton and associates of Santa Paula are the owners.

These exposures are prominent and outcrop boldly for over two miles; and the beds have a probable thickness of 1000 feet. The owners have made a large number of opencuts along the outcrops, and a number of trails have been built, which also exposed the material. This material is white, gray, and yellow in color, and if closer to railroad transportation, would be of commercial importance.

#### GYPSUM.

Deposits of gypsum occur interbedded with diatomaceous shales on the low divide between Upper and Lower Ojai Valleys, on South Mountain and Oak Ridge. Owing to the association of the gypsum with clay and other impurities, the deposits have not been worked in recent years.

Ojai Gypsum Mine is three miles east of Ojai on a low divide that separates the two Ojai valleys. The deposit was worked in 1890 by the Tacoma Calcium Company, which sank a shaft and did considerable drifting. The gypsum developed in the workings is said to have contained numerous small stringers of black clay. This made hand sorting necessary, and the property was abandoned. Workings caved.

Bibl: State Mineralogist's Reports VIII, p. 688; Bull. 38, p. 288. U. S. Geol. Surv. Bull. 223, p. 122.

South Mountain Deposit, owner, Joshua Stockton, Santa Paula. The deposit is located on the south slope of South Mountain at an elevation of 2000 feet, about four miles south of Santa Paula. The gypsum occurs interbedded with the diatomaceous shales, is soft and white, and massive but granular in texture. Undeveloped.

Sunset Plaster and Cement Company, Fillmore, worked a deposit of gypsum in Secs. 12 and 13, T. 3 N., R. 20 W., S. B. B. and M., four miles by road south of Fillmore. The gypsum occurs interbedded with diatomaceous shales which strike east and west with a flat dip to the north. The gypsum is white and massive.

This deposit is reported to have produced 10,000 tons, and was

operated from 1911 to 1915. Idle.

#### LIMESTONE.

The only known deposits of limestone of commercial importance are beds outcropping in Matilija Canyon. The most prominent beds occur associated with clay and lime shales, southwest of Matilija Creek, and have a general east and west strike. This belt of limestone is two miles north of Matilija Springs, and the outcrops are exposed for a distance of several miles. North of Lyons Springs, on the north side of the Canyon is another prominent outcrop of limestone, which can be traced for several thousand feet. This material is said to be a natural rock cement.

Argilla Group of Claims is located in Secs. 23 and 24, T. 5 N., R. 24 W., S. B. B. and M., nine miles northeast of Ojai. Owner, E.

Duryea, Hollingsworth Bldg., Los Angeles.

A massive bed of limestone striking east, and dipping south, is exposed on the south side of the canyon. This deposit has been recently sampled and the rock is said to be excellent natural cement. An analysis of an average sample as given by E. Duryea is as follows:

Silica	16.015%
Aluminum and Iron Oxide	5.320%
Lime	42.630%
Magnesia	1.119%
Carbon dioxide	34.190%

A good wagon road goes as far as Lyons Springs, and a good trail for the remaining distance.

Matilija Group of Claims comprises two claims located in Sec. 19, T. 5 N., R. 23 W., eight miles north of Ojai. Owner, Joshua T. Stockton

and J. A. Barry of Santa Paula.

Beds of hard blue limestone are exposed along the top of the ridge north of Matilija Canyon, about one-half mile north of Lyons Springs. The outcrop of blue limestone strikes east and west, and is about 75 to 100 feet in thickness. This outcrop is exposed for a distance of about one-half mile. In a side canyon below the outcrop are exposures of lime shale. The rock is said to be an excellent natural cement. Undeveloped.

Ventura Cement Company Deposit. This deposit is one mile above Vickers Hot Springs and 12 miles north of Ojai. Holdings comprise 500 acres of patented land, located in Secs. 22, 23, 26, and 27, T. 5 N., R. 25 W., S. B. B. and M. Owner, Ventura Cement Company; Frederick Hartman, president; Alfred Roth, vice president; Frederick Sheldon, secretary, Ventura.

Outcroppings of beds of limestone are exposed in a side canyon south of Matilija Creek, one mile above Vickers Hot Springs. These deposits are undeveloped, but of such extent as to be of great potential value. The rock is stated to be an excellent natural cement. An analysis of this limestone has been made by the U. S. Testing Laboratory of St. Louis, and also by the Riverside Portland Cement Company.

# Analyses of Natural Cement Rock.

Made by U. S. Testing Laboratory of St. Louis.

	Per cent	Per cent
Silica	10.82	8.68
Alumina	4.34	3.20
Magnesia	1.66	1.27
Carbon dioxide	36.47	37.89
Lime	47.13	48.80
-		
Totals	100.42	99.84

### FOSSILIFEROUS LIMESTONE.

Gillibrand Limestone Deposit, located five miles north of Santa Susana, a station on the Southern Pacific Railroad, in Secs. 17 and 18, T. 3 N., R. 17 W., S. B. B. and M. Owner, E. C. Gillibrand of Santa Susana.

Holdings consist of 200 acres, of which 100 acres, located in Sec. 18 is under lease to the *Ventura County Lime and Fertilizer Company* of Santa Paula, California. J. G. Leavans, president; Charles Wright, secretary.

A massive bed of fossiliferous limestone is exposed on the western slope of the Santa Susana Mountains, north of Simi Valley. The general strike of the marine shell lime belt is northeast, with a dip of 30° to the southeast. The exposure on the property is about 3000 feet in length, and has an average width of 300 feet. It is a decomposed shell deposit of lime. Analysis by Smith Emery Company:

CaO		54.64%
C02		42.86%
CaCo ₃	0.77	97.50%
P ₂ O ₅	07	to .33% 2.07%
Insoluble		2.0170

The material is suitable for fertilizer, and has been used to some extent by citrus growers of the county.

### MICA.

A deposit of muscovite occurs on the northeastern slope of Alamo Mountain, in Secs. 12, 13, and 24, T. 7 N., R. 20 W., S. B. B. and M. The country rock is granite, gneiss, and mica schist. The mica occurs in a feldspar gangue, between a granite hanging and a mica-schist footwall. It is said that some sheets of mica 3 x 4 inches were mined, but that the product was mostly scrap mica. The deposit was developed by the Mount Alamo Mica Company of San Francisco in 1907. Workings caved. Abandoned.

# MINERAL PAINT.

South Mountain Deposit. Beds of soft red shales are exposed on the north slope of South Mountain. The thickness of the beds is about 60 feet, and they extend for several hundred feet. The material is of uniform brick red color, and pulverizes readily upon crushing, leaving little or no grit.

There was a small production from the deposit in 1923. The prop-

erty has been in litigation.

### MOLDING SAND.

Deposits of molding sand occur on a ridge north of Ventura. The sand is exposed in Buena Vista Canyon, and also in another canyon to the east on the McElrea Ranch. The sand is very fine-grained, has a good bond, and has been used in local foundries. A considerable tonnage has been shipped to Los Angeles.

Ventura Velvet Molding Sand Deposit is located within the city limits of Ventura, on a ridge south of Buena Vista Canyon, a mile north of the Southern Pacific Railroad Station, at Ventura. Owner, Charles A. Cole, Ventura, California. Holdings consist of 28 acres.

A bed of unconsolidated sandy loam and fine-grained sand, said to be 100 feet thick is exposed in the canyon. The quarry is 200 feet in length and 75 to 100 feet in height. The material is handled with scrapers to the bins, then screened through No. 4 mesh revolving screen, oversize going to a set of rolls.

Quality: The sand is very fine-grained. About 96 per cent of the sand will pass through 100 mesh, and 48 per cent through 200 mesh.

The sand has a good bond.

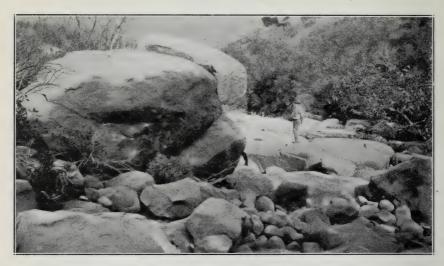
Analysis.	
Silica Iron oxide Aluminum oxide Calcium oxide Magnesium oxide Alkalies Loss in ignition and undetermined	8.75% 12.75% 3.07% 2.70% 2.40%
Total	100 25%

### PETROLEUM AND NATURAL GAS.

Ventura County production of petroleum for the year 1923 amounted to 3,610,794 barrels valued at \$4,109,084. In addition to this, natural gas was reported as valued at \$470,261.

The producing oil fields occur in the south central portion of the county. The principal productive fields of the county are Barsdale, Ojai, Piru, Santa Paula, Sespe, Simi, South Mountain, and Ventura. For detailed description of the different oil fields of the county, see Bulletin No. 69, 'Petroleum Industry of California'; also State Oil and Gas Supervisor's Annual Reports.

Bibl: State Mineralogist's Reports VII, p. 101; VIII, p. 684; XII, p. 357; XIII, p. 585; Bulletins 11, 19, 32, 63, 69, and 89. U. S. Geol. Surv. Bulletins 309, 691m, 753. Summary of Operations, California Oil Fields, Vol. 5, No. 8; Vol. 10, No. 5.



Boulders of Brown Sandstone. Sespe Canyon, Ventura County.

### PHOSPHATES.

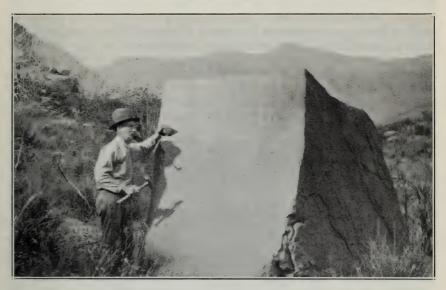
Small deposits of white phosphates occur along the top of South Mountain, four miles south of Santa Paula, on the homestead of Joshua Stockton. These phosphates are in a thin strata scattered through the soft sandstone which crumbles readily in the hand. The owner reports that samples of the material sent to Los Angeles for analysis contained 5 per cent calcium phosphate. Undeveloped.

### SANDSTONE.

The sandstone industry of the county has greatly decreased in the past few years, and only one quarry remains at which any stone has recently been quarried. For many years building stone was quarried from the large boulders and broken slabs of the Sespe brownstone in Sespe Canyon. This is a hard brown sandstone, uniform in texture and color and very resistant to weathering, as shown by the bold outcropping ledges and the fresh surfaces of the broken slabs. Massive beds of buff-colored sandstone outcrop two miles east of Santa Susana.

Beds of white siliceous sandstone outcrop in Matilija Canyon. Some building stone was cut from the boulders of this tough sandstone at Wheelers Hot Springs for local use.

Santa Susana Quarry is located in Sec. 16, T. 2 N., R. 17 W., S. B. B. and M., two miles east of Santa Susana. Massive beds of buff-colored



Block of Brown Sandstone. Sespe Canyon, Ventura County.



Beds of Brown Sandstone. Sespe Canyon, Ventura County.

sandstone were quarried by the Southern Pacific Railroad Company, and the stone used for rip-rap work along the road bed. The sandstone proved to be too soft for this purpose. Idle.

Bibl: Bulletin 38, p. 327.

Sespe Canyon Brownstone Quarry is in Sec. 35, T. 5 N., R. 20 W., and Sec. 2, T. 4 N., R. 20 W., S. B. B. and M. George J. Henley,

Sespe, owner.

The quarry is five miles north of Brownstone, a station on the Southern Pacific Railroad. The brown sandstone is exposed on both sides of the Sespe River. It is also exposed in the small tributary canyons such as Coldwater Canyon, east of the river. On the north side of the river the brown sandstone occurs in heavy, massive beds, with two sets of nearly rectangular joint planes, so that it lies in huge cubical blocks which have a gentle dip to the north and east. The brownstone series consist of sandstones, shales, and conglomerates, with a total thickness of 800 feet or more. On the hill west of the river about 800 feet above it, the shales have been eroded, exposing the top of the sandstones over a large area. A number of water-courses have cut deep tributary canyons into this hill, exposing the edges of sandstone layers from 15 to 20 feet thick, and in places forming perpendicular cliffs from 30 to 50 feet in height.

Good quarries of excellent brownstone could be opened at many places in this hill. The stone is a typical brownstone; the coarser-grained varieties have a rich purplish-brown color, and the finer-grained stone is a light reddish brown. Very little stone has been cut from the sandstone layers, and most of the material shipped has been quarried from boulders in Sespe Canyon. This material has been used in a great many buildings in different cities in California. Six thousand cubic feet of the stone were used in the Methodist

Episcopal Church at Pasadena during 1924.

Massive beds of hard white siliceous sandstone are exposed on the north side of Coldwater Canyon. Only a small amount of stone has been quarried from this deposit. This white sandstone rests conformably on the brownstone. Only assessment work has been done.

Bibl: Bull. No. 11, p. 26; No. 19, p. 94; No. 38, pp. 142–145.

#### STONE INDUSTRY.

The rapid growth of the cities and towns of Ventura County has caused an increased demand for building materials, especially crushed rock, sand, and gravel. These materials are also used for construction of buildings, concrete and road work. A number of gravel and sand plants are under operation on the Santa Clara and Ventura Rivers.

# CRUSHED ROCK, SAND, AND GRAVEL PLANTS.

Saticoy Rock Company, A. G. Wright, president; W. F. Blackie, secretary; A. H. Stovall, manager, Saticoy. The crushing plant is located on the Santa Clara River, one mile southeast of Saticoy. The company controls 1000 acres along the river. The capacity of the plant is 550 yards per nine-hour day.

The gravel from the pits is loaded into a train of three side-dump cars, having a capacity of four yards each, by a Byers Model No. 10 bucket hoist. The cars are hauled by a Plymouth 7-ton gasoline motor to storage bins, where they are dumped over a grizzley, the bars being

spaced ten inches apart.

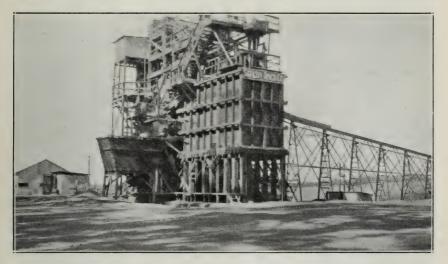
All boulders that will not pass the grizzly are stored in the yard. From the receiving bins the 10-inch and finer gravel is transported

by 30-inch belt conveyor to a No. 4 Universal crusher, where it is crushed to pass a 3-inch ring. The product from the crusher is elevated by bucket elevator to a Gilbert system of screens. The oversize material from the screening plant goes to a Weston Gyratory crusher, and is re-elevated to the screening plant. The material passes through Gilbert revolving screens, making the following products:  $2\frac{1}{2}$ ",  $1\frac{3}{4}$ ",  $1\frac{1}{4}$ ",  $1\frac{1}{4}$ ", and sand. The sand goes to two 12-inch log washers.

The capacity of the storage bunkers for the product is 480 yards. Trucks are loaded by means of gates from each bin. Electric power is used to operate the plant, the total power being 137 horsepower. The cost of operation varies from 50 to 60 cents per yard. Eight men

are employed.

Ventura Rock and Sand Company, W. T. Rodman, Ralph T. Ogilvie, and John Ward of Ventura, owners. The company operates two



Saticoy Rock Company Gravel Plant. Saticoy, Ventura County.

plants; one is located on the Santa Clara River, one-half mile south of Montalvo; the other on the Ventura River within the city limits of Ventura. No. 2 Plant. At the Montalvo plant the material is taken from the river and is hauled by scrapers to the hopper. It then passes through a No. 2 Universal crusher; the crushed material is elevated to a revolving screen, where it is screened dry. Products produced are 2'',  $1\frac{1}{2}''$ ,  $\frac{1}{2}''-\frac{1}{4}''$ , and sand. Capacity of the plant is 150 yards per nine-hour day. Six men are employed.

No. 1 Plant. This plant is located  $1\frac{1}{2}$  miles east of the bridge on the Ventura-Santa Barbara Highway, on the Ventura River. Boulders and rock are hauled from the river bed by wagons to the hopper, where it passes to a No. 3 Austin erusher and is crushed to pass a 2-inch ring. The crushed product is elevated to revolving screens. The products made are  $1\frac{1}{2}$ ",  $1\frac{1}{4}$ ", 1", and  $\frac{1}{2}$ "- $\frac{1}{4}$ ". The capacity of the plant is 50 yards per nine-hour day. A 20-h.p. motor drives the plant. Six

men are employed.

# OIL FIELD DEVELOPMENT OPERATIONS.

R. D. BUSH, State Oil and Gas Supervisor.

From January 25, 1925, to and including April 11, 1925, the following new wells were reported as ready to drill:

Company	Sec.	Twp.	Range	Well No.	Field
FRESNO COUNTY:					
Pacific Oil Co	25	20	14	107	Coalinga
Pacific Oil Co. Penn Coalinga Petroleum Co.	1	20	14	14	Coalinga.
Premier Oil Co Zier Oil Co	24	20 20	14 14	$\frac{29}{26}$	Coalinga Coalinga.
KERN COUNTY:					
Elk Hills Development Co.	14	30	22	2	Elk Hills
Pacific Oil Co	27	30	24	23	Elk Hills
Pacific Oil Co.	35	30	24	75	Elk Hills
Pacific Oil Co.	35	30	24	Warm Country	Elk Hills
Standard Oil Co	31	30	25	Kern County Lease 1 21	Elk Hills
Union Oil Co	26	30	24	Elk Hills 10	Elk Hills
Kern 29 Oil Co	29	31	30	2	Kern River Kern River
Marland Oil Co.	16	28 28	27 27	Cauley 12	Kern River   Kern River
Marland Oil Co C. E. and S. T. Vermilyea Wilmar Oil Co	16	28	28	Cauley 14	Kern River
Wilmar Oil Co.	20	28	28	6	Kern River
Wilmar Oil Co.	20	28	28	7	Kern River
Oleo Fluo Co.	28	30	22	$\frac{2}{2}$	McKittrick
Standard Oil Co	25 25	29 29	21 21	Weston 1	McKittrick McKittrick
Washington Petroleum Corp.	8	30	22	4	McKittrick
Balboa Oil Co.	24	31	23	46	Midway
Balboa Oil Co.	24 23	31	23	48	Midway
Blair Oil and Refinery Co Boston Pacific Oil Co		32	23 24	1-A 7-C	Midway Midway
Formax Oil Co.		32	23	18	Midway
Formax Oil Co.		32	23	7-A	Midway
Formax Oil CoGeneral Petroleum Corp	32	31	24	10	Midway
Gilmore Oil Co Honolulu Consolidated Oil Co	27	31 32	22 24	$\frac{1}{12}$	Midway Midway
Honolulu Consolidated Oil Co.	6	32	24	24	Midway
Honolulu Consolidated Oil Co  Honolulu Consolidated Oil Co  Honolulu Consolidated Oil Co	6	32	24	35	Midway
Honoillii Consolidated On Co	1 0	32	24	55 56	Midway
Honolulu Consolidated Oil Co Honolulu Consolidated Oil Co	6 4	32	24 24	61	Midway Midway
Manley & McGinn	15	31	22	11	Midway
Midland Oilfields Co. Ltd	24	31	23	15	Midway
		31	23	16 17	Midway Midway
Midland Oilfields Co., Ltd. Midland Oilfields Co., Ltd. Midland Oilfields Co., Ltd. Midway Pacific Oil Co.	24 34	31 31	23 24	2-B	Midway
Midland Oilfields Co., Ltd.	34	31	24	Thornber B 1-A	Midway
Midway Pacific Oil Co	24	31	22	10	Midway
North American Oil Cons.	02	31	24	$\frac{2}{3}$	Midway Midway
North American Oil Cons North American Oil Cons	32	31	24 24	17	Midway
North American Oil Cons.		31	24	18	Midway
North American Oil Cons.	. 30	31	24	19	Midway
North American Oil Cons.	30	31	24 24	20	Midway Midway
Pacific Oil Co.	19	31	24	5 7	Midway
Pacific Oil Co.	19	31	24	8	Midway
Pacific Oil Co.	19	31	24	12	Midway
Pacine Oil Co		31	24 24	25 47	Midway Midway
Pacific Oil Co.		31	24	60	Midway
Pacific Oil Co.	25	31	23	67	Midway
Pacific Oil Co	. 31	31	24	71	Midway
Pacific Oil Co.	. 1	32	23 24	98 Dorothy 1	Midway Midway
Petroleum Midway Co., Ltd Pinal Dome Corp		31	24	Wier 2	Midway
The Ransom Oil Co.	36	32	23	2	Midway
The Ransom Oil Co. St. Helens Petroleum Co., Ltd.	1	32	24	Miller & Lux 1	Midway
Standard Oil Co	91	31	23	Eagle Creek 31	Midway Sunset
Atlas Oil Co	30 28	12	23 24	27	Sunset
C J Berry	34	12	24	Hillside 13	Sunset
C. J. Berry Frank O. Chittenden General Petroleum Corp.	18	11 11	23 24	1 59-A	Sunset Sunset

### OIL FIELD DEVELOPMENT OPERATIONS—Continued.

Company	Sec.	Twp.	Range	Well No.	Field
KERN COUNTY—Continued.					
		1	1	00.1	~ .
General Petroleum Corp.	12 35	11 12	24 24	69-A 350	Sunset
Midway Oil Co	35	12	24	375	Sunset Sunset
Midway Oil Co.	35	12	24	376	Sunset
Midway Oil Co Milham Exploration Co	1	11	24	Milham Kern	
	36	10	24	Sunset 1	Sunset
Standard Oil Co.	36	12 12	24	M.J.M. & M. 58 M.J.M. & M. 59	Sunset Sunset
General Petroleum Corp.	28	11	20	4	Wheeler Ridge
Standard Oil Co. General Petroleum Corp. Standard Oil Co.	28	11	20	Kern County	
Standard Oil Co	28	11	20	Lease 2 17 Kern County	Wheeler Ridge
Hitchcock & Cottle	21	30	21	Lease 2 18	Wheeler Ridge Kern County
			-		Troin County
LOS ANGELES COUNTY:					T. 1 YY
Associated Oil Co.	25 3	1 4	15 13	Fox Hills 101 Dominguez 7	Beverly Hills Dominguez
Marland Oil Co	33	3	13	Callender 10	Dominguez Dominguez
Union Oil Co.	33	3	13	Callender 11 Callender 12	Dominguez
Union Oil Co	32	3	13	Callender 12	Dominguez
The United Oil Co. and Henderson	9	4	13	Dominaus F	Dominguez
Associated Oil Co	7		14	Dominguez 5 Vickers 1	Inglewood
Petroleum Corp.  Associated Oil Co.  Associated Oil Co.	3 7 7 7 7 7 7 7 7 7	222222222222222222222222222222222222222	14	Vickers 2	Inglewood
Associated Dil Co	7	2	14	Vickers 5	Inglewood
Associated Oil Co.	7	2	14	Vickers 8	Inglewood
Associated Oil Co. Associated Oil Co. O. R. Howard & Co.	7	2	14 14	Vickers 9	Inglewood Inglewood
O. R. Howard & Co	7	2	14	2	Inglewood
O. R. Howard & 30.	7	2	14	3	Inglewood
Mohawk Oil and Gas Syn	7	2	14	2	Inglewood
Mohawk Oil and Gas Syn.	17	2	14 14	Sentous 2	Inglewood Inglewood
Pan American Pet. Co Pan American Pet. Co	17	2	14	Sentous 7	Inglewood
Patroleum Midway Co., Ltd		2	14	Moynier 1	Inglewood
Petroleum Midway Co., Ltd	8	2	14	Moynier 3	Inglewood
Petroleum Midway Co., Ltd.	7	2	14	Smith 1	Inglewood
Petroleum Midway Co., Ltd	7	2	14	Smith 2 Smith 5	Inglewood Inglewood
Petroleum Securities Co.	8	2	14	Cone 1	Inglewood
retroieum securities Co	8	2	14	Cone 2	Inglewood
Petroleum Securities Co	887778878878	2	14	Cone 3	Inglewood
Petroleum Securities Co Petroleum Securities Co	8	2	14	Cone 4 Cone 6	Inglewood Inglewood
Petroleum Securities Co	7	2	14	Lloyd 1	Inglewood
Shell Co	8	2	14	Rindge 1	Inglewood
Standard Oil Co. Standard Oil Co. Standard Oil Co.	17	2	14	L. A. Inv. 1 4 L. A. Inv. 1 5	Inglewood Inglewood
Standard Oil Co.	17 17	2	14	L. A. Inv. 1 5	Inglewood Inglewood
Standard Dil Co	17	2	14	L. A. Inv. 1 6 L. A. Inv. 2 2	Inglewood
Standard Oil Co.	8	2	14	Vickers 1 2 Vickers 1 3	Inglewood
Standard Oil Co. Standard Oil Co. Standard Oil Co.	17	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	14	Vickers 1 3	Inglewood
Standard Oil Co.	17	2	14	Vickers 1 4 Vickers 2 1	Inglewood
Standard Oil Co		2	14	Vickers 2 2	Inglewood
Shandard Dil Co	7 7	2	14	Vickers 2 3	Inglewood Inglewood
Universal Consolidated Oil Co.	18	2	14	1	Inglewood
Wilshire Oil Co., IncAtlas Drilling & Development Co	6	2	14	0,1011 07	Inglewood
Atlas Drilling & Development Co	24 24	4 4	13 13	O'Donnell 37 Roger 1	Long Beach Long Beach
Hub Oil Co	13	4	13	Woodward 1	Long Beach
Hub Oil Co. and Pugh-Miller Drilling	24	4	13	Hunt 1	Long Beach
CoHub Oil Co. and Pugh-Miller Drilling					
Co.	24	4 4	13	Wellman 1	Long Beach Long Beach
A. T. Jergins Trust Co	24	4	12 13	O'Donnell 38	Long Beach
Richmond Oil Co.	19	4	12	1	Long Beach Long Beach
Richmond Oil CoShell Co	29	4	12	Hutton Comm. 6	Long Beach
Union Oil Co.	30	4	12	Long Beach Comm. 12	Long Beach
McGipley Oil Co	6	2	11	Comm. 12 20	Montebello
McGinley Oil Co. McGinley Oil Co. Ed Mayhugh et al. Barnsdall Oil Co.	6	2	11	21	Montebello
Ed Mayhugh et al.	17	2 2 3 3 3	16	1	Newhall
	20	1 2	13	Rosecrans 5	Rosecrans

# OIL FIELD DEVELOPMENT OPERATIONS—Continued.

Company	Sec.	Twp.	Range	Well No.	Field
LOS ANGELES COUNTY—Contd.					
	7	9	10		TD.
E. L. Blanton C. C. M. O. Co. E. E. Combs	7	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	13	Dill on 1	Rosecarns
F F Comba	7	3	14 13	Bilhorn 1	Rosecrans
Courtney Petroleum Co.	7	3	13	15	Rosecrans Rosecrans
DeLendrecie Oil Well	2 7 7 7 7 7 7 7 7 7 7 7	3	13	Athens 1	Rosecrans
Dominion Oil Co	7	3	13	Athens 1	Rosecrans
Dominion Oil Co.	7	3	13	Athens 3	Rosecrans
Elbe Oil Land Development Co.	7	3	13	1	Rosecrans
Elbe Oil Land Development CoElbe Oil Land Development Co	7	3	13	2	Rosecrans
Elbe Oil Land Development Co	7	3	13	3	Rosecrans
Walter H. Fisher Corp	7	3	13	9	Rosecrans
Walter H. Fisher Corp.	7	3	13	10	Rosecrans
Walter H. Fisher Corp.	7	3	13	11	Rosecrans
Wm. E. Garner General Petroleum Corp.		3	13	1 , 1	Rosecrans
Constal Petroleum Corp.	18	3	13	Vaughn 1-A	Rosecrans
General Petroleum Corp.	18	3	13	Vaughn 2-A	Rosecrans
Bud Gerner	18 77 77 77 77 77 77 77 77 77	9	13	Bob Gerner 1	Rosecrans
George F. Getty, Inc. George F. Getty, Inc. George F. Getty, Inc. George F. Getty, Inc.	7	3	13 13	Athens 4 Athens 5	Rosecrans Rosecrans
George F. Getty, Inc.	7	3	13	Athens 6	Rosecrans
George F Getty Inc	7	3	13	Athens 2-A	Rosecrans
J Paul Getty	7	3	13	Athens 2-A	Rosecrans
J. Paul Getty Golden State Refineries, Inc	7	3	13	Bydal 1	Rosecrans
Nathan W Hale	7	3	13	Dydai 1	Rosecrans
Nathan W. Hale Henderson Petroleum Corp	7	3	13	Athens 1	Rosecrans
Henderson Petroleum Corp.	7	3	13	Athens 2	Rosecrans
Hercules Gasoline Co.	7	3	13	2	Rosecrans
Henderson Petroleum Corp	7	3 3 3 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	13	Athens Comm. 2	Rosecrans
Julian Petroleum Corp.	7	3	13	Athens Comm. 3	Rosecrans
Marine Corp.	7	3	13	34	Rosecrans
Marine Corp.	7	3	13 13	35	Rosecrans
Marine Corp.	7	3	13	40	Rosecrans
Marine Corp.	7	3	13	42	Rosecrans
Marine Corp.	7	3	13	43	Rosecrans
Leland Mitchell	7	3	13	1	Rosecrans
Leland Mitchell	7	3	13	2	Rosecrans
Mohawk Oil Co.	7	3	13	Dixon 1	Rosecrans
Painted Hills Oil Assn. Pan American Petroleum Co.	- 7	3	13	A-1	Rosecrans
Pan American Petroleum Co	1	3	14	Anderson	D
F A Parkford	7	9	13	Western 2 Athens 1	Rosecrans
E. A. Parkford	7	9		Athens 1	Rosecrans
I T Pohertson Co	7 7	9	13	1	Rosecrans Rosecrans
J. T. Robertson Co. Sentinel Oil Co.	7	3 3 3	13 13	Athens 4	Rosecrans
Superior Oil Co	20	3	13	Maxwell	Rosecrans
Duperior On Co	20		10	Comm. 4	Rosecrans
Superior Oil Co.	20	3	13	Maxwell	Teobectans
Naporior our con			10	Comm. 6	Rosecrans
Superior Oil Co	20	3	13	Maxwell	10000014110
				Comm. 7	Rosecrans
The Twin State Oil Co	7	3	13	1	Rosecrans
The Twin State Oil Co	7 7	3	13	Green 1	Rosecrans
Union Oil Co.	17	3	13	_ Chandler 2	Rosecrans
Union Oil Co	18	3	13	Howard Park 10	Rosecrans
Union Oil Co Union Oil Co Union Oil Co	18	30 73 73 73 73 73 73 73 73 73 73 73 73 73	13	Howard Park 11 Howard Park 12	Rosecrans
Union Oil Co.	18	3	13	Howard Park 12	Rosecrans
Union Oil Co.	18	3	13	Howard Park 13	Rosecrans
Union Oil Co.	18	3	13	Howard Park 14	Rosecrans
Union Oil Co.	18	3	13	Howard Park 15 Howard Park 16 Howard Park 17	Rosecrans
Union Oil Co	18	3	13	Howard Park 16	Rosecrans
Union Oil Co.	18 18	3	13 13	Howard Park 17 Howard Park 18	Rosecrans Rosecrans
	18	9		Howard Park 18	
Union Oil Co.	18	3	13	Howard Park 19 Howard Park 20 Howard Park 21	Rosecrans Rosecrans
Union Oil Co Union Oil Co.	18	3	13 13	Howard Park 20	Rosecrans
Union Oil Co.	18	3	13	Trust 3	Rosecrans
Union Oil Co Wilson, Gordon & Walker	7	3	13	11450 3	Rosecrans
Shell Co.	11	3	11	Stubbs 1	Santa Fe Springs
C C M O Co.	8	4	14	Del Amo 16	Torrance
Shell Co. C. C. M. O. Co. C. C. M. O. Co.	16	4	14	Del Amo 36	Torrance
	16	4	14	Del Amo 42	Torrance
C. C. M. O. Co.	16	4	14	Del Amo 48	Torrance
C. C. M. O. Co	16	4	14	Del Amo 48 Del Amo 54	Torrance
C. C. M. O. Co. C. C. M. O. Co. C. C. M. O. Co.	15	4	14	Torrance 74	Torrance
General Petroleum Corn.	30	4	13	Poggi 6	Torrance
General Petroleum Corp.	30	4	13	Poggi 7	Torrance
	30	4	13	Poggi 8	Torrance

# OIL FIELD DEVELOPMENT OPERATIONS—Continued.

Company	Sec.	Twp.	Range	Well No.	Field
LOS ANGELES COUNTY—Contd.  George F. Getty, Inc	8 25 14 19 30 30 14 9 9	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	14 14 14 13 13 13 14 14 14 14	Torrance 24 51 Carlson 2 Kleinmeyer 10-B Kleinmeyer 11-B Kleinmeyer 16-B 11 Fenger 3 Redondo Comm. 4 Dominguez 12 Ellinwood 2	Torrance
Standard Oil Co. Superior Oil Co. Van Alen Oil Co. Central Oil Co. of Los Angeles Whittier-Strong Oil Co. Antelope Oil & Gas Co. Midway Gas Co. Russell Oil Co. Shell Co. Standard Oil Co. Union Oil Co.	22 30 30 30 19 22 23 22 11 8 25 11 23 10	4 4 4 4 4 4 2 2 7 3 3 3 2 2	14 13 13 13 14 11 11 12 14 17 11 12 15	Marble Lease 2 3 Torrance 59 Torrance 60 Torrance 61 Torrance 63 7 75 3 Leuzinger 1 Stubbs 1 Hadley 1 Newlin 1	Torrance Torrance Torrance Torrance Torrance Torrance Whittier Whittier Los Angeles County
ORANGE COUNTY:	0		10		D 01 1
Brea Canon Oil Co C. C. M. O. Co. Shell Co Shell Co Shell Co Birch & Royer General Petroleum Corp Julian Petroleum Corp	2 8 1 2 2 24 2 2	3 3 3 3 3 6 6	10 9 10 10 10 10 11 11	37 96 Fisher 3 Orange 3-A Pico 3-A Nenno 1 Dabney 4 Fosnaugh	Brea Olinda Brea Olinda Brea Olinda Brea Olinda Brea Olinda Coyote Hills Huntington Beach
Petroleum Midway Co., Ltd Shell Co Southern California Drilling Co Standard Oil Co Sound Standard Oil Co E. S. Bruee Interstate Oil Corp John E. Otto South Basin Oil Co Chicksan Oil Co Craig Burns & Co Standard Oil Co Union Oil Co Associated Oil Co Standard Oil Co	11 2 2 12 2 34 2 4 4	6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	11 11 11 11 11 11 11 11 11 11 10 10 10 1	Brown 1 Brown 6 Davenport 7 Riggle 3 Farnsworth 4 Huntington B 30 Huntington B 33 Huntington B 33 Huntington B 34 Thomson 6 2 Mesa 2 1 5 3 1 Kramer 2 19 Olinda 1 Hellman 1 Irvine 1	Huntington Beach Newport Newport Newport Newport Richfield Richfield Richfield Richfield Orange County Orange County
SAN BENITO COUNTY: Henry Harper				1	San Benito County
SAN BERNARDINO COUNTY: The Arapahoe Petroleum Co	8	15	8	1	San Bernardino Co.
SAN LUIS OBISPO COUNTY:  Henry R. Dabney Lloyd Tevis	Ī2	27 31	10 21	Emericka 1	San Luis Obispo Co. San Luis Obispo Co.
SAN MATEO COUNTY:  A. & C. Oil Co C. C. Julian & Co	17 16	6 6	5 5	1 4	San Mateo County San Mateo County

# OIL FIELD DEVELOPMENT OPERATIONS—Concluded.

Company	Sec.	Twp.	Range	Well No.	Field
SANTA BARBARA COUNTY:					
Union Oil Co.		9	34	Escolle 15	Casmalia
Palmer Union Oil Co.	26	9	33	8	Cat Canyon
General Petroleum Corp	36	10	35	Bradley 3	Santa Maria
VENTURA COUNTY:					
W. C. Currier	34	2	20	7	Conejo
W. C. Currier	34	2	20	9	Conejo
J. A. Hess	4	1	20	2 3	Conejo
J. A. Hess	4	1	20	3	Conejo
Rio Virgin Oil Syn.	4	1	20	1	Conejo
Henry R. Dabney	33	5	18	Kaar 1	Piru
Temescal Petroleum Co	4	4	18	Landers 2	Piru
Empire Oil Co.	13	4 4	21	E. P. 1	Santa Paula
Miller Oil & Refining Co	33	5	20	1-A 19	Sespe
Oak Ridge Oil Co.	18	3	20	Willard 17	Sespe South Mountain
Oak Ridge Oil Co.	13	3	20	Yale Williard 17	South Mountain
Oak Ridge Oil Co	15	3	21	Richardson 4	South Mountain
Santa Paula Oil Co.	18	3	20	Santa Paula 15	South Mountain
Union Oil Co.	13	3	21	Caldwell &	South Mountain
Chion on co	10	0	21	Snyder 1	South Mountain
Associated Oil Co.	27	3	23	Lloyd 15	Ventura
General Petroleum Corp	28	3	23	Barnard 4-A	Ventura
E. J. Milev	12	3	24	Casitas 1	Ventura
Shell Co.	28	3 3 3 3 3	23	Edison 3	Ventura
Shell Co.	28	3	23	Edison 4	Ventura
Shell Co.	27	3	23	Gosnell 11	Ventura
Shell Co.	28	3	23	Gosnell 14	Ventura
Shell Co	28	3	23	Gosnell 15	Ventura
Shell Co	28	3	23	Taylor 8	Ventura



### SPECIAL ARTICLES.

Detailed technical reports on special subjects, the result of research work or extended field investigations, will continue to be issued as separate bulletins by the Bureau, as has been the custom in the past.

Shorter and less elaborate technical papers and articles by members of the staff and others are published in each number of 'Mining in

California.

It is anticipated that these special articles will cover a wide range of subjects both of historical and current interest; descriptions of new processes, or metallurgical and industrial plants, new mineral occurrences, and interesting geological formations, as well as articles intended to supply practical and timely information on the problems of the prospector and miner, such as the text of new laws and official regulations and notices affecting the mineral industry.

### CALIFORNIA FOUNDRY SANDS.

In December, 1921, a Joint Committee on Molding Sand Research was organized by the American Foundrymen's Association and the Engineering Division of the National Research Council for the purpose of carrying on detailed tests and research work on all samples of sand thought to be suitable for foundry use. Samples were to be collected by the Geological Surveys of the various states and forwarded to the testing stations. Three stations were designated for making the tests, viz. Cornell University, Ithaca, New York, the University of Illinois, Urbana, Ill., and the U. S. Bureau of Standards, Washington, D. C.

It was understood that no tests were to be given to private parties in advance of their publication, and that both the American Foundrymen's Association, and the State Geologists should have the right to make the results of the tests public as soon as they desired through

their official mediums of publication.

The California State Mining Bureau was invited to cooperate in this work so that foundrymen and producers of molding sand in California could take advantage of this opportunity to learn more of the qualities of sands found in the state. Steps were at once taken by the State Mineralogist to advise producers of the details of the plan. Twelve samples of foundry sand were accordingly collected by the State Mining Bureau from eight producers of such sands, and forwarded to the U. S. Bureau of Standards, Washington, D. C. Geological data concerning the deposits were at the same time forwarded to one of the Joint Committee's sub-committees, that on Geological Surveys, for inclusion in the final report. In order to facilitate the work, the following facts and suggestions were supplied by the committee. As some of those interested in the subject of molding sand may not see the complete report, these notes are included herein and follow in substantially the same form.

The investigation of the problem of molding sands was undertaken, not only with a view to standardizing the methods of testing them, but also to consider the topics of blended sands, the reclamation of old

sands, synthetic sands, and the possible sources of supply.

Some foundries obtain their molding sand from nearby sources but in many cases the material is hauled several hundred miles from the pit to the point of consumption, and thus the freight adds greatly to the cost of material.

Furthermore there is danger of exhaustion of certain well-known deposits which have been drawn upon extensively to supply foundries

over a wide territory.

The problem of interest to the foundrymen and geologic surveys is therefore two-fold: viz, to discover additional sources of supply, nearer, if possible, to points of consumption, and to discover deposits, which alone may not be suitable, but which can be used as ingredients of synthetic mixtures.

The molding sand resources of some states may seem well known, but this is only partly true, and moreover the fact that it is possible now to make artificial mixtures, which in many cases are equal to the natural ones formerly employed, opens up a field of usefulness for cer-

tain sands formerly regarded as worthless.

It seemed highly desirable, therefore, that a thorough and intensive study should be made of the sand, gravel, and loam deposits of the different states, and also of those high silica sandstones which could be used after crushing.

Character of raw materials. The sands used for foundry work are obtained from two kinds of rock: 1. Friable siliceous sandstone, and 2. Unconsolidated deposits of sand, gravel, or sandy loam.

The products obtained from these deposits are divisible into the

following classes:

Molding Sand. The sand used for molding is composed of sand grains, and a bonding material. The grains are mostly quartz, but in part feldspar. Freedom from mica is desirable. The bond may be clay or hydrous iron oxide, and should be evenly distributed through the sand. The grain ranges from coarse to fine, depending on the kind of casting to be made. Fine sands may be roughly determined by feel and inspection. The bond may be roughly gauged by squeezing some moist sand in the hand, and then noting how the lumps resist breaking. The degree of bonding power is not in direct relation to the amount of clay which the sand contains, but rather upon the quality and amount of colloidal material present.

Core Sand. Core sand is usually composed of silica grains but some contain other minerals, of which feldspar is often abundant. Some core sands carry little or no bonding material, and it is necessary to add this. While a high silica content is desirable, the presence of some feldspar does no particular harm. Even small amounts of the other fusible impurities are not objectionable. The grains may be either rounded or angular.

The table gives the texture of a coarse core sand.

Molding gravels. Much very coarse strongly-bonded gravelly sand is used for foundry work. The gravel is always coarser than the run of graded molding sands, and it is rarely used for any other work than heavy eastings. The larger pebbles may run approximately 4-inch in

diameter. The pebbles should be of silica, and the bond is clay. On account of the coarseness of the material the bond should be strong.

The table gives the texture of two molding gravels.

Steel Sand. This should consist of pure quartz grains, angular or rounded. It may be a natural sand or crushed sandstone. A uniform grain is desirable, and the average range of size is from 20 to 150 mesh. Steel sand is selected primarily for its refractoriness, and hence the impurities should be low.

The table gives the texture of a steel sand.

Fire Sand. This is a highly siliceous, refractory sand. It may contain some feldspar, and hence is not as pure as steel sand. There may also be a small percentage of bonding substance such as clay or hydrous iron oxide. The sand may sometimes run so coarse as to be called gravel. Fire sand is mixed with fire clay to make cupola and ladle linings, and for other refractory uses in the foundry.

Parting Sand. This is a pulverized fine quartz sand, which usually passes 100 mesh.

The sandstones used are in general those with little Sandstones. cement, which crush easily.

	Sier	e Tests	of Mold	ing San	ds.			
	1	2	3	4	5	6	7	8
On 120 mesh	.4 .2 .4	9.8 1.1 1.1 1.3 1.3 3.6 15.5	3.8 9.8 22.8 6.5 14.8 13.7 7.5 13.5 7.6	$\begin{array}{c} 8.4 \\ 5.2 \\ 18.5 \end{array}$	$\begin{array}{c} 3.2 \\ 5.0 \\ 11.4 \\ 13.6 \\ 6.2 \\ 22.4 \\ 9.5 \\ 16.6 \\ 12.1 \\ 87.9 \\ 12.1 \end{array}$	.7 .4 4.9 6.5 8.8 22.8 10.4 32.1 13.4	0. .2 6.0 9.4 12.8 26.8 10.4 23.1 11.3	$egin{array}{c} .3 \\ 1.2 \\ 25.6 \\ 10.1 \\ 16.6 \\ 10.8 \\ 6.8 \\ 16.0 \\ 12.6 \\ \end{array}$
On 20 mesh		$\begin{array}{c} .6 \\ 2.1 \\ 6.1 \end{array}$	10 0. .3 2.9 1.6 2.6 11.3 9.3 57.9	11 13. 79.4 4.8 .6 .5 .4 .2 .3 .8 84.2 14.8	12 7. 35.5 16.3 4.8 3.6 2.1 4.5 10.4 14.8	$   \begin{array}{c}     34.1 \\     10.6 \\     7.8   \end{array} $	14 4.7 48.1 38.2 5.2 1.5 1.0 .1	15  10.5 15.2 74.3

1. Millville gravel. 2. Gravel. 3. Coarse sand, No. 3 Albany. 4. Coarse sand, No. 3 Jersey. 5. Medium molding sand. 6. Medium sand, No. 1½ North River. 7. Medium sand, No. 2 Albany. 8. No. 2 North River. 9. Fine sand, No. 00 Albany. 10. Fine sand, No. 0 Albany. 11. Coarse core sand. 12. Facing sand. 13. Fire sand. 14. High silica steel sand. 15. Parting sand.

The points which it seemed desirable to include in a field investigation are the following:

- 1. Location of sand deposits, including relation to transportation routes.
- 2. Kind of formation containing sand,

It makes no difference if the grains retained on 20 mesh sieve are 1 inch or larger. 'It makes no difference if the grains retained on 20 mesh sieve are \( \frac{1}{2} \) inch or larger. When they reach \( \frac{1}{2} \) inch they are regarded as excessively large, and are usually removed from the molding sand by the molders when they riddle the sand through a \( \frac{1}{2} \) inch ridde. A sand which in its natural condition contains 5% of \( \frac{1}{2} \) inch pebbles should be rejected.

2Mr. Hanley, chairman of the sub-committee on standard tests states "that when the sand is hydrated iron oxide instead of clay, it generally acts the same as clay substance." "Clay substance" of course is a misnomer, but it is comprehensive to the foundryman in that it is bonding substance, and that is what he is interested in.

3. Dimensions of individual deposits.

4. Structural position or structure, and degree of uniformity of deposit.

5. Character and thickness of overburden.

6. Distribution of grains of different texture; that is

(a) Whether uniformly mixed or separated.

(b) If separated whether in patches which are due to crossbedded structure, or whether in regular beds.

(c) If in separated masses, thickness and extent of each, in order to indicate whether it is profitable to dig them separately, or whether the bank should be worked as a whole.

(d) Shape of grains, whether angular, subangular or round. (It remains to be decided which shape of grain gives the best results in foundry practice. From the standpoint of permeability and venting the less sharp the better.)

7. Approximate amount of bonding material, as determined by hand test, and whether of clay or hydrous iron oxide.

8. Mineral composition of grains, so far as this can be determined with a hand lens.

9. Calcareous or non-calcareous character, as determined by acid test.

10. Degree of consolidation, and nature of cementing material.

11. Presence of lumpy impurities, such as concretions or clay lumps; nature and size of same.

12. Method of working to be employed, whether as a bank or pit.

13. Method of taking sample, whether from face of bank, borings or otherwise.

14. Name of owner of property, and if deposits are being worked; for what purpose.

The fact that a sand is being used at the present time by some foundry is not to be regarded as conclusive evidence that all its uses are known; nor is the statement of one foundry that a sand is no good to be taken as definitely indicating its worthlessness.

References on Molding Sands. As some of those interested in the investigation of molding sands may desire to consult some articles on the subject, a selected list of references is given below.

### References to Articles on Properties and Testing of Molding Sand.

1913 "American Foundrymen's Association Tests of Molding Sand"-by R. Moldenke, Trans. A. F. A. 21: 1-125. "Testing Molding Sands"—by L. H. Cole, Trans. Canadian Mining Inst.

1917 20: 165-91.

- 1917 "Principles of Iron Founding"-by R. Moldenke, McGraw-Hill 278-305.
- "Refactory Furnace Sands"-by C. Jones, Trans. Faraday Society 12: 168. 1917 1918 "Part II, Memoir on British Resources of Refractory Sands for Furnace and Foundry Purposes"—by P. G. H. Boswell, Taylor-Francis, London.

1919 "A Comparison of American and British Molding Sands"—by P. G. H. Boswell, Foundry, 47: 592-5.

"Refractory Sands, Nature, Origin and Properties"-Hook Products, July & 1919 August, 1919, Vol. 22.

"Practical Analysis of Molding Sand"—By Hayes, Iron Age 103: 739-41. 1919

1919 "Molding Sands for Non-Ferrous Work"-by P. G. H. Boswell, Engineering 108: 418-20.

1920 "Testing and Judging Sands for Foundry Use"-by Hanley and Simonds. Foundry 48: 741-6, 772-4, 867-8 and 921-2.

# References to Annual Reports on Molding Sands.

New York, Twenty-first Report of New York State Geologist, "Molding Sand, its Uses, Properties, and Occurrence," pp. 91-96, by Eckel, E. C.

Newland, D. H., Amer. Foundrymen's Association, 1915, (Albany Sand). New Jersey, "Annual Report of State Geologist of New Jersey for 1904," pp. 189-

246, by Kummell, H. B.

Wisconsin, Geological Natural History Survey Bulletin XV, "The Clays of Wisconsin and their Uses, Containing a Report of Midwestern Molding Sands," by H. Ries.

Virginia, Virginia Geological Survey, "Mineral Resources of Virginia," Molding Sands, by H. Ries.

Michigan, Geological Survey, "Foundry Sands," by Ries and Rosen.

Missouri Bureau of Geology and Mines, Second Series, Vol. 15.

Georgia Geological Survey Bulletin No. 37, "Sand and Gravels of Georgia," by Teas, L. P.

"Steel Molding Sand in Ohio," by J. A. Bownocker. A pamphlet issued by Ohio State Geological Survey—Reprinted from the Ohio Journal of Science, Vol. XXI, No. 8.

The results of the tests on the samples from California producers, as determined by the Committee, are given in the following table. The figures representing the highest bonding strength and greatest permeability are shown in black face type. It will be noted that these qualities vary with the per cent of water.

CALIF

Lab. No.	Locality	Grade if used	On 6	On 12	On 20	On 40
1 2	Pacific Grove, Monterey County Pacific Grove, Monterey County	Core	0.00	. 0.00	0.00	11.11 58.09
3	Ventura, Ventura County	"Velvet" molding sand	0.00	0.00	0.26	0.31
4	Riverside, Riverside County	Molding	0.00	0.65	1.75	1.72
5	San Diego, San Diego County	Molding	0.00	0.25	1.03	2.38
. 6	San Diego, San Diego County	Molding	0.00	0.00	0.20	0.82
7	San Diego, San Diego County	Molding	0.00	0.00	0.12	0.25
8	San Diego, San Diego County	Molding	0.00	0.00	0.07	0.05
9	4 miles north of Corona, Riverside County	Molding	0.00	0.00	1.43	5.78
10	4 miles S. W. of Corona, Riverside County.	Molding	0.00	1.46	3.58	11.84
11	Ben Ali Siding, Sacramento County	Molding	0.00	0.00	2.71	13.11
12	Decoto, Alameda County	Molding	0.00	0.00	0.00	6.38

^{*}Black-face figures represent the best developed bond strength and permeability.

### ORNIA.

On 70	On 100	On 140	On 200	On 270	Thru 270	Clay subs	Total	Dye adsorp.	Water, per cent	*Bond strength	*Perme- ability
87.07 40.26	1.74 0.02	0.03	0.04 0.00	0.00	0.00		99.99 99.93	74 72	0 0		242.83 460.07 7.49
0.54	0.39	0.44	9.26	0.11	0.59	88.17	100.08	1,672	$   \left\{     \begin{array}{c}       4.7 \\       6.9 \\       8.5 \\       10.6     \end{array}   \right. $	149.95 152.53 149.74	8.81 8.71
2.11	1.42	0.44	15.98	1.15	1.36	73.35	99.93	1,440	4.4	180.44 187.90 184.20	5.25 6.14 5.63
6.27	2.67	0.20	19.44	0.27	5.86	61.63	100.00	2,736	3.3 4.0 6.0 8.2 9.7	184.20 199.48 210.59 179.73 174.60	11.14 11.77 13.28
3.28	2.05	1.28	2.76	0.12	0.98	88.60	100.09	5,136	11.7 6.4 8.6 9.9 11.7 12.1	169.38 187.76 193.55	10.86 2.66 3.16 3.33 4.09
0.61	0.49	0.13	11.96	0.39	5.62	80.41	99.96	4,104	5.7 7.8 10.0 11.7 12.3	174.58 176.81 177.14 158.20	5.6 5.6 7.0 <b>7</b> .8
0.14	0.23	0.23	21.93	0.05	5.23	72.02	99.95	2,840	3.1 4.1 5.8 8.0	128.88 130.96 128.84	9.7 10.4 11.8
19.84	11.23	2.11	21.49	0.68	1.79	35.54	99.89	1,008	8.0 6.0 7.9 9.9 5.7	124.15 122.61 146.10 141.40	10.00 14.00 15.30 15.20
23.27	9.75	1.85	18.11	0.12	2.97	27.05	100.00	1,672	7.8 9.9 11.6 11.8	140.65 141.40 149.87 151.59 136.40	11.94 16.24 16.34 14.14
16.45	4.33	0.21	6.04	0.00	0.00	56.05	98.90	1,040	2 00 3.9 5.6	208.40	64.75 56.13 44.63 19.10
6.38	5.71	8.38	18.46	0.01	1.00	59.55	99.98	1,440	7.9 10.5 6.1 7.8 10.5 13.0	215.43 161.96 206.30 215.49 190.80	15.2- 0.4- 3.6- 4.4- 5.8- 4.3-

## ADMINISTRATIVE DIVISION.

WALTER W. BRADLEY, Deputy State Mineralogist.

Personnel.

There have been no changes of personnel to be noted, since the January quarterly went to press.

### New Publications.

During the quarterly period covered by this issue the following Bureau publications have been made available for distribution:

Mining in California (quarterly), January, 1925, being Chapter No. 1 of State Mineralogist's Report XXI. Price 25 cents.

Summary of Operations, California Oil Fields: Vol. 10, Nos. 4, 5, and 6, October, November, and December, 1924, respectively.

Commercial Mineral Notes: Nos. 22, 23, 24, 25, January-April (inc.). These 'notes' carry the lists of 'mineral deposits wanted' and 'minerals for sale,' issued in the form of a mimeographed sheet, monthly. It is mailed free of charge to those on the mailing list for 'Mining in California.'

### Mails and Files.

The Bureau maintains, in addition to its correspondence file, a mine report file which includes reports on some 7500 mines and mineral properties in California. Also, there is available to the public a file of the permits granted to mining and oil corporations by the State Commissioner of Corporations.

During the period covered by this quarterly report, there were 2792 letters received and answered at the San Francisco office alone, covering almost every conceivable phase of prospecting, mining and developing mineral deposits, reduction problems, and marketing of refined products.



## DIVISION OF MINERALS AND STATISTICS.

Statistics, Museum, Laboratory.

WALTER W. BRADLEY, Deputy State Mineralogist.

### STATISTICS.

California continues to produce commercially, as for some years past, more than fifty different mineral substances (the number reached 54 in 1923, which will probably be exceeded in 1924, when all the returns are in), the total annual value of which for 1924 as shown in the January issue of MINING IN CALIFORNIA (see page 123, ante) was estimated at \$358,745,000.

At the present writing (May 1st), reports are in hand from most of the producers. Data for several substances are now complete and have

been compiled, being presented herewith.

The information at hand indicates that there was no production in California during 1924 of the following substances, which have at one time or another in the past been on the active list here: Antimony, barytes, bismuth, cadmium, fluorspar, graphite, mica, molybdenum, serpentine, slate, strontium, and tin. There was production by a single operator in each, of the following: Andalusite, arsenic, calcium chloride, and sulphur, the figures for which will have to be combined under the 'unapportioned' item in the final report. The output of arsenic was the first in commercial quantity, of record in California. In addition to the above, there are potential deposits of ore of the following which have not as yet yielded a commercial output: Aluminum, cobalt, nickel, and vanadium.

### ASBESTOS.

In 1924, a total of 70 tons of crude asbestos ore and fibre valued at \$4,750 was shipped from Californian properties, being an increase over the 20 tons and \$200 reported in 1923. This was mainly due to the shipments of short-fibre chrysotile from San Benito County to the Orient. The 1924 figure also includes amphibole asbestos utilized in

magnesite composition flooring.

The future of asbestos mining in California is dependent largely upon the development of uses in quantity for the short-fibre mill grades, and for the amphibole variety. There are apparently large resources of such material that can be made available. Some spinning-grade fibre has also been found in this state, notably in Nevada, Calaveras, and Monterey counties, but the commercial yield to date has been small.

### BITUMINOUS ROCK.

Small amounts of bituminous rock are still occasionally used for road dressing in those districts adjacent to available deposits, though the manufacture of asphalt at the oil refineries has almost eliminated the direct use of the native material. During 1924, a total of 6040 tons valued at \$14,922 was shipped from quarries in Santa Barbara and Santa Cruz counties, compared with 2945 tons and \$11,780 in 1923.

This material is essentially an uncemented sandstone which is saturated with and held together by a natural asphaltic constituent probably the residue from the evaporation of a crude petroleum deposit.

#### BORATES.

During 1924, there was produced in California a total of 93,273 tons of borate materials, compared with a total of 118,601 tons for the year 1923. The material shipped in 1924 included crude and selected colemanite ore from Inyo and San Bernardino counties varying from 18.6% to 26.9% anhydrous boric acid ("A.B.A."), also crystallized borax recovered by two plants from evaporation of brines at Searles Lake in San Bernardino County.

As the crude ore is not sold, as such, but is almost entirely calcined before shipping to the refinery for conversion into the borax of commerce, and because of the fact that the material varied widely in boric acid content, we have re-calculated the tonnage to a basis of 40% A.B.A. This is approximately the average A.B.A. content of the colemanite material after calcining, and also of the crystallized borax obtained from evaporation of the lake brines.

Re-calculated as above, the 1924 production totals 52,070 tons valued at \$1,599,149, a decrease from the similar figures for 1923 which were

62,667 tons and \$1,893,798.

#### CEMENT.

Cement is the most important single structural material in the mineral output of this state. During 1924, there was produced a total of 11,655,131 barrels, valued at \$23,225,850 f. o. b. plant. This is an increase of 829,726 barrels over the previous record figure of 10,825,405 barrels in 1923; but a decrease of \$2,773,353 from the 1923 value of \$25,999,203. The lower sales prices prevailing in 1924 were due to the competition of foreign cements brought over in ballast and dumped onto our local markets duty-free. There is no import duty on

this foreign cement, the bulk of which came from Belgium.

As in the preceding three years, the output came from nine operating plants in seven counties, and in 1924 employing a total of 3081 men. The three plants in San Bernardino County made a total of 4,354,119 barrels valued at \$7,571,370, the balance of the state's product coming collectively from a single plant in each of the following counties: Contra Costa, Kern, Riverside, San Benito, Santa Cruz, and Solano. For 1925, the new plant of the Pacific Portland Cement Company at Redwood City, San Mateo County is operating, and utilizing marine shells as a source of calcium carbonate. The Yosemite Portland Cement Company is building a plant at Merced, and will use limestone from a deposit on the Merced River in Mariposa County.

### CHROMITE.

Chromic iron ore, or chromite, to the amount of 250 short tons, re-calculated to a basis of 45% Cr₂O₃, valued at \$4,500 f. o. b. rail-shipping point was sold in California during the year 1924. This was principally of ore that had been mined during the World War period, but not then sold. It is hoped that the development of the steel industry and the resumption of copper smelting on the Pacific Coast may create some demand for California's chromite, but the outlook for the immediate future is not encouraging.

#### DOLOMITE.

The production of dolomite for the year 1924 totaled 28,843 tons valued at \$81,271 being a decrease from the 69,519 tons and \$142,615 of 1923, and came from a total of eight quarries in Inyo, Monterey, San Benito, and Tuolumne counties. The decrease was due mainly to a falling off of shipments from Inyo and Monterey counties. The material shipped was utilized for steel-furnace lining, manufacture of  $\mathrm{CO}_2$ , flux, burned dolomitic lime, for stuceo dash-coat, and terrazzo.

## FULLER'S EARTH.

The production of 5290 tons valued at \$67,295, here credited to 1924 as 'fuller's earth' is in reality colloidal clay of the montmorillonite class (sold under such local names as 'bentonite', 'otaylite', shoshonite', derived from the locality where found). Because of its being utilized for clarifying, filtering, and cleanser purposes, most of it in petroleum refining, we have placed it for the purposes of this statistical report, under the 'fuller's earth' heading. After all, the practical test of a fuller's earth is not so much chemical, as a practical, physical one; that is, its physical capacity to absorb basic colors and to remove these colors from solution in animal, vegetable, or mineral oils, also from water.

The 1924 output above noted is an increase over the 3650 tons and \$55,125 credited to the year 1923.

#### GEMS.

The production of gem materials in California has been somewhat irregular and uncertain since 1911. The compilation of complete statistics is difficult owing to the widely-scattered places at which stones are gathered and marketed for the most part in a small way. The materials reported in 1924 totaled \$4,800 in value, compared with \$13,220 in 1923; the decrease being due mainly to less activity in the tourmaline district of San Diego County.

The following table shows the distribution of rough, uncut gem and jeweler's materials during 1924:

County
Butte
San Diego

Calaveras Imperial San Mateo

Total value

Value Kind
\$225 Diamond, topaz, sapphire.
1,925 Kunzite, tourmaline, spessartite and pyrope garnets, hyacinth, pink and aquamarine beryl, quartz.

[Quartz crystals.]
[Quartz crystals.]
[Jumortierite.]
[Jasper.]

\$4,800

*Combined to conceal output of a single operator in each.

#### GYPSUM.

During 1924, one operator each in Imperial, Riverside, and San Bernardino counties produced a total of 25,569 tons of gypsum valued at \$53,210 compared with 86,410 tons worth \$188,336 in 1923. The material was utilized mainly in cement manufacture as a retardant, for hard-wall plaster, and for fertilizer. The considerable drop from the record figure of 1923 was due to smaller shipments from both Imperial and San Bernardino counties. The property of the Imperial Gypsum and Oil Company in western Imperial County has been taken

over by the Pacific Portland Cement Co., Consolidated, and there is promise for a considerable increase in output.

#### LITHIA.

Lithia mica, lepidolite (a silicate of lithium et al) utilized in the manufacture of artificial mineral water, fireworks, glass, etc., has been mined in San Diego County since 1899, except between 1905 and 1915. Some amblygonite, a lithium phosphate, is occasionally also obtained from pockets associated with the gem tourmalines. In 1924 a total of 109 tons valued at \$2,269 was shipped, in which was included a small tonnage of amblygonite. The lepidolite was utilized in glass manufacture.

#### MAGNESITE.

The production of magnesite in California during 1924 amounted to a total of 67,236 tons of crude ore valued at \$900,183. Only a small part of it was sold 'crude,' however, as it is practically all shipped in the calcined form. The reports at hand show a total of 29,235 tons shipped calcined, of which 2925 tons were dead-burned and sold for refractory purposes, the balance going to the plastic trade. From 2 to  $2\frac{1}{2}$  tons of crude material are mined to make one ton of calcined. The 1924 output is a slight decrease both in quantity and value from the 1923 figures of 73,963 tons crude valued at \$946,643. The average of the values reported for 1924 is \$13.40 per ton as against \$12.80 in 1923.

The more important producing properties in 1924 were: Maltby No. 1 (Western Magnesite Development Co., operated under lease by C. S. Maltby), on Red Mountain, Santa Clara County; and the Sierra Magnesite Company's group near Porterville, Tulare County; followed in order, by the Sampson Peak Mine (Maltby No. 3), San Benito County; California Magnesia Company (old Harker mine) at Porterville; and Maltby No. 2 in Chiles Valley, Napa County. Lesser amounts were reported mined in Fresno and Stanislaus counties.

#### MAGNESIUM SALTS.

The production of magnesium chloride and sulphate in California during 1924 totaled 4823 tons, valued at \$145,883, an increase both in quantity and value over the 1923 figures of 3662 tons and \$116,031. This was nearly all chloride, sold for use in magnesite stucco and cement mixtures (Sorel cement), and with one exception, was prepared from residual bitterns at salt plants in Alameda, Los Angeles, San Diego, and San Mateo counties. It was in part marketed in the liquid form. The exception consisted of a natural sulphate shipped from one of the desert dry lakes in Inyo County by the American Magnesium Company and refined at their plant at Wilmington. The sulphate marketed was utilized for medicinal and bath purposes.

With the use of magnesite cement and stucco coming more into prominence in building construction on the Pacific Coast, the demand for magnesium chloride is increasing here; but the domestic article has to meet the competition of the cheaper, imported German chloride.

The average value reported for the chloride produced in California in 1924 was approximately \$29 per ton, f. o. b. plant.

#### MINERAL PAINT.

Mineral paint materials were produced in California in 1923 from a total of three properties in Placer and Stanislaus counties, amounting to 532 tons valued at \$5,234. This is a decrease from the 1049 tons and \$11,773 of 1923. The material shipped from Placer County is hematite, and that from Stanislaus, yellow ochre.

#### ONYX and TRAVERTINE.

Onyx and travertine are known to exist in a number of places in California, but there has been only a small and irregular production since the year 1896. In 1924, a total of three operators in Mono and Solano counties shipped 24,350 cubic feet valued at \$4,300 as compared with 14,220 cubic feet and \$2,510 in 1923. The Solano County material is utilized mainly for terrazzo.

#### PLATINUM.

In California platinum is obtained as a by-product from placer operations for gold. The major portion of it comes from the dredges working in Butte, Calaveras, Sacramento, Stanislaus, and Yuba counties, with smaller amounts from the hydraulic and surface-sluicing mines of Del Norte, Humboldt, Shasta, Siskiyou, and Trinity.

The production of platinum-group metals in California for the year 1924 totaled 337 ounces, crude, containing 273 fine ounces, valued at \$36,452. Of this amount, a total of 275 ounces, crude, or 82%, came from the gold dredges. This is less than 50% of the 602 fine ounces worth \$78,546 sold in 1923, the decrease being due to cessation of

dredging in Shasta and to a lessened output in Yuba County.

The above-noted total of 273 fine ounces includes 84 fine ounces of osmiridium and iridium, also some palladium. Most of the platinum refiners pay for the osmiridium on the basis of its iridium content. Crude 'platinum' is really a mixture of the metals of that group, and carries varying percentages of platinum, iridium, and osmiridium or iridosmine, with occasionally some palladium. Iron, in amount from 5% to 15% is found alloyed naturally with most platinum as are also smaller amounts of palladium, rhodium, iridium, and osmium, also sometimes from 0.5% to 2% of copper. Osmiridium (iridosmine) sometimes also carries ruthenium in addition to the other members of the group above mentioned.

In addition to the above-noted production, there is usually some platinum recovered as a by-product in the gold refinery of the Mint, but which can not be assigned to the territory of its origin for lack of knowing to which lots of gold it belongs. The San Francisco Mint has recovered as high as 100 ounces of platinum in a single year from this source, some of which unquestionably came from Californian mines. Some platinum and palladium are also recovered in the elec-

trolytic refining of blister copper.

For 1924, the distribution by counties of California's platinum vield was as follows:

#### Platinum Production, by Counties, 1924.

County	Fine ounces	Value
Butte Shasta	(a) 2 0 2 7	\$2,829 3,361
Trinity	11	1,839
Calaveras, Del Norte, Humboldt, Mendocino, Sacramento,ª	73	8,773
Siskiyou, Stanislaus*	142	19,650
Totals	273	\$36.452

(a)Includes palladium.
*Combined to conceal output of a single operator in each.

#### POTASH.

During 1924, a total of 33,107 tons of potash salts of all grades was produced in California valued at \$747,407, compared with 29,597 tons and \$709,836 in 1923. This included potassium chloride from saltworks bitterns and from Searles Lake brine, and sulphate from Portland-cement dust. The quality varied from 30% to 61.25% equivalent K2O content, these salts being produced at plants in Alameda, San Bernardino, San Mateo, and Santa Cruz counties. The product sold was utilized mainly for the manufacture of fertilizers, and some for caustic potash (KOH). PYRITES.

A total production of 124,214 short tons of pyrites, valued at \$517,835, was reported shipped in California during 1924, from properties in Alameda, Mariposa and Shasta counties. This was a decrease both in tonnage and value from the figures of 148,004 tons and \$555,308 The material was mostly used in the manufacture of sulphuric acid for explosives and fertilizers, but a portion was utilized directly in the preparation of agricultural fertilizer and insecticide. The sulphur content ranged up to 46.9% S.

#### QUICKSILVER.

Quicksilver was produced in California in seven counties during 1924 to the amount of 7948 flasks valued at \$543,080, being an increase of nearly 50% both in amount and value over the 1923 output of 5458 flasks and \$332,851. The average price received during 1924, according to the producers' reports to the State Mining Bureau, was \$68.33 per flask, as against \$60.98 in 1923, and the record average of \$114.03 for the year 1918.

The average of San Francisco quotations for 1924 was \$68.69 per flask, the price varying from \$59.35 in January, to \$75 in April, declining to \$69 early in December, but ending the year at \$72.65. For the current year, 1925, quotations are ranging higher, the present

figure (May 2) being \$81.35.

The above-noted yield of 7948 flasks in 1924 was won from a total of 61,595 tons of ore, being an average content of 9.7 pounds per ton, or 0.485% mercury.

The increase in 1924 was due to greater output at the New Idria

mine in San Benito County.

The U.S. Geological Survey reports the total production of the United States for 1924 at 9600 flasks (75 pounds, net), valued at \$659,424 (using the \$68.69 average of quotations). Outside of California, the principal yield was from Texas, with a few flasks from Nevada, Oregon, Idaho, and Alaska. California's contribution was 82.5% of the total.

The 1923 quicksilver production in California was distributed by

counties, as follows:

#### Quicksilver Production by Counties, 1924.

County	Flasks	Value
San Benito Sonoma Lake, Monterey, Napa, Santa Clara, San Luis Obispo*	$4,670 \\ 867 \\ 2,411$	$   \begin{array}{r}     \$320,758 \\     60,840 \\     161,482   \end{array} $
Totals	7,948	\$543,080

^{*}Combined to conceal output of a single operator in each.

#### SOAPSTONE and TALC.

The total output of talc and soapstone in California in 1924 amounted to 16,179 tons valued at \$242,770, compared with 17,439 tons valued at \$252,661 in 1923. More than three-fourths of the product was high-grade talc from Inyo and San Bernardino counties, which material was utilized mainly in toilet powders, paint, paper, and rubber manufacture, and in part in magnesite stucco and flooring. The 'soapstone' grades were used mainly for roofing and as a filler in roofing paper, and part also in magnesite cement.

#### SODA.

The production of natural carbonates and sulphate of sodium in California in 1924 included soda ash and bicarbonate from plants at Owens Lake, Inyo County; trona ('sesqui-carbonate', a double salt of Na₂CO₃ and NaHCO₃) from Searles Lake, San Bernardino County; and salt cake (sulphate) from the Carrizo Plains, San Luis Obispo County. The total amount to 32,536 tons, valued at \$711,796, being a slight decrease both in tonnage and value from the 1923 figures of 34,885 tons and \$764,284.

The dense ash and bicarbonate were used in the manufacture of soap, sal soda, glass, and chemicals; the salt cake in glass making; and

the trona for neutralizing, in flotation concentration.

#### TUNGSTEN.

The commercial production of tungsten ores and concentrates in California began in 1905; and has been continuous since, with the exception of 1920–1922 (inclusive), when the mines were shut down owing to low prices due to excess stocks following the war and to lack of tariff protection against foreign importations. Production was resumed on a small scale late in 1923. For 1924, a total of 705 tons of all grades, or 781 tons re-calculated to 60% WO₃ was shipped, valued at \$446,009, being an increase over the 34 tons and \$19,126 of 1923. The material shipped in 1924 included both high-grade sorted ore and concentrates, coming from properties in Inyo and San Bernardino counties.

Prices in 1924 varied around \$9.00 to \$10.00 per unit of  $WO_3$  for high-grade scheelite. The present quotation (May 2, 1925) is \$11.00 per unit.

#### MUSEUM.

The Museum of the State Mining Bureau possesses an exceptionally fine collection of rocks and minerals of both economic and academic value. It ranks among the first five of such collections in North America; and contains not only specimens of most of the known minerals found in California, but much valuable and interesting material from other states and foreign countries as well.

Mineral specimens suitable for exhibit purposes are solicited, and their donation will be appreciated by the State Mining Bureau as well

as by those who utilize the facilities of the collection.

The exhibit is daily visited by engineers, students, business men, and prospectors, as well as tourists and mere sightseers. Besides its practical use in the economic development of California's mineral resources, the collection is a most valuable educational asset to the state and to San Francisco.

#### LABORATORY.

FRANK L. SANBORN, Mineral Technologist.

Bauxite has been reported from a number of different localities in California, but as yet only one authentic deposit is known, and this occurs in Sec. 26, T. 4 S., R. 6 W., S. B. M. in Riverside County. It is possible that there are undiscovered deposits of this valuable oxide of aluminum in the southern part of the state.

Bauxite resembles clay, but is usually distinguished at sight from clay by its pea-shaped, or pisolitic structure—a structure having small

rounded concretions of the mineral imbedded in the mass.

A large deposit of bauxite in California would be commercially

valuable for refractories and other purposes.

The demand is still good for pyrite and galena crystals suitable for radio crystal detectors. At the present time the price paid per ton for good pyrite crystals is probably about \$2,000, and about \$750 for galena.

The number of samples received and determined at the laboratory of the State Mining Bureau during the past three months has been

1119.

#### LIBRARY.

FOREST L. CAMPBELL, Librarian.

In addition to the numerous standard works, authoritative information on many phases of the mining and mineral industry is constantly being issued in the form of reports and bulletins by various government agencies.

The library of the State Mining Bureau contains some five thousand selected volumes on mines, mining and allied subjects, and it is also a repository for reports and bulletins of the technical departments of federal and state governments and of educational institutions, both domestic and foreign.

It is not the dearth of the latter publications, but rather a lack of knowledge of just what has been published and where the reports may be consulted or obtained, that embarrasses the ordinary person seeking specific information.

To assist in making the public acquainted with this valuable source of current technical information, 'Mining in California' contains under this heading a list of all books and official reports and bulletins received, with names of publishers or issuing departments.

Files of all the leading technical journals will be found in the library, and county and state maps, topographical sheets and geological folios. Current copies of local newspapers published in the mining centers of the State are available for reference.

The library and reading room are open to the public during the usual office hours, when the librarian may be freely called upon for all necessary assistance.

#### OFFICIAL PUBLICATIONS RECEIVED.

#### Governmental.

U. S. Geological Survey:

Bulletin No. 750-G—Bauxite in Northeastern Mississippi. By E. F. Burchard. Bulletin No. 769—The Geologic Classification of the U. S. Geological Survey as Compared with Other Classifications. By M. G. Wilmarth.

Bulletin No. 761—Molybdenum Deposits. By Frank L. Hess.

Bulletin No. 760-B-The Physical Features of Cent. Massachusetts.

Bulletin No. 755—Mineral Resources of Alaska in 1922. By A. H. Brookes. Bulletin No. 764—Phosphate Deposits in the Wind River Mountains near Lander, Wyoming. By D. D. Condit.

Bulletin No. 770-The Data of Geochemistry. By F. W. Clarke.

Mineral Resources of the United States:

Antimony in 1923.

Abrasive Materials in 1923.

Natural Gas in 1923.

Asbestos in 1923.

Natural Gas Gasoline in 1923.

Gold, Silver, Copper, Lead and Zinc in Nevada in 1923. Gold, Silver, Copper, Lead and Zinc in Utah in 1923.

Gold, Silver, Copper, Lead and Zinc in California and Oregon in 1923.

Gold, Silver, Copper, Lead and Zinc in Montana in 1923.

Gold, Silver, Copper, Lead and Zinc in Arizona in 1923

Gold, Silver, Copper, Lead and Zinc in Washington and Idaho in 1923.

Iron Ore, Pig Iron and Steel in 1923.

Cement in 1923.

Water Supply Paper No. 538—The San Juan Canyon, Southeastern Utah.
Water Supply Paper No. 560-A—Water Power and Irrigation in the Madison

River Basin, Montana.

Water Supply Paper No. 520-E-The Artesian Water Supply of the Dakota Sandstone in North Dakota.

Water Supply Paper No. 541-North Atlantic Slope Drainage Basins.  $\mathbf{B}\mathbf{y}$ N. C. Drover.

Water Supply Paper No. 519—Ground Water in Santa Clara Valley, California. By W. O. Clark.

#### U. S. Bureau of Mines:

Technical Papers:

322—Experiments in the Use of Back Pressures on Oil Wells.

332-Conditions Affecting the Activity of Iron Oxides in Removing Hydrogen Sulphide from City Gas.

337—Carbon Monoxide Hazards from House Heaters Burning Natural Gas.

338—Smoke-Abatement Investigation at Grafton, W. Va.

348-Gas Masks for Gasoline and Petroleum Vapors. 351—The Electrical Manufacture of Carbon Black.

352—Detection of Small Quantities of Petroleum Vapor. 359—The Purification of Copper Sulphate Solutions.

371—Coke Oven Accidents in the United States during 1923.

#### Reports of Investigations:

Serial No. 2658-Pollution by Oil of the Coast Waters of the United States. By F. W. Lane, C. P. Bowie and J. S. Desmond.

Serial No. 2659—Explosives used in October, 1924. By W. W. Adams.

Serial No. 2660-Health Hazards in the Mining Industry. By R. R. Sayers. Serial No. 2661—Exhaust Gases from Engines using Ethyl Gasoline. By R. R. Sayers, A. C. Fieldner, W. P. Yant, B. G. H. Thomas, and W. J. McConnell.

Serial No. 2663—Friction Factors for Metal Mine Airways. By G. E. McElroy and A. S. Richardson.

Serial No. 2664—Hazard of Unsafe Types of Gas Masks. By S. H. Katz. Serial No. 2665—Explosives used in November, 1924. By W. W. Adams.

Serial No. 2666—Coal-Mine Fatalities in December, 1924. By W. W. Adams. Serial No. 2667—Subject Index of Bureau of Mines Reports of Investigations Published during the Calendar Years 1919-1924. By G. E. Tufft and E. V. Brandenburg.

Serial No. 2668—A Test of CO₂ Recorders. By J. F. Barkley. Serial No. 2672—Explosives used in December, 1924. By W. W. Adams. Serial No. 2673—Coal-Mine Fatalities in January, 1925. By W. W. Adams.

Serial No. 2671—The Resistance of Coal-Mine Entries to the Flow of Air. By J. W. Paul, H. P. Greenwald and G. E. McElroy.

Serial No. 2669—Status of Research in Ore Dressing. By Earnest A. Hersam.

Serial No. 2670—Possibilities of Helium-Oxygen Mixtures for the Mitigation of Caisson Disease. By R. R. Sayers, W. P. Yant and J. H. Hillebrand. Serial No. 2674—The Ignition of Firedamp by Exposed Filaments of Electric Mine-Lamp Bulbs. By R. D. Leitch, A. B. Hooker and W. P. Yant.

Serial No. 2675—Eleventh Semi-Annual Motor Gasoline Survey. By A. J. Kraemer and H. M. Thorne.

Serial No. 2676—Explosives Used in January, 1925. By W. W. Adams, Serial No. 2677—Effect of Tank Colors on Evaporation Losses of Crude Oil. By Ludwig Schmidt.

Serial No. 2678—Some Common Mistakes in Operating a Stoker-Fired Boiler. By J. F. Barkley.

Serial No. 2679—Methods of Laboratory Grinding of Coke for Analysis. By W. A. Selvig.

Serial No. 2680—Coal-Mine Fatalities in February, 1925. By W. W. Adams.

#### California Department of Engineering:

Bulletin No. 9-Water Resources of California.

California Department of Public Works:

Report of the Division of Architecture, 1924.

#### Alabama, Geological Survey of:

Bulletin No. 25-Statistics of the Mineral Production of Alabama for 1919 and 1920.

Bulletin No. 26-Statistics of the Mineral Production of Alabama for 1921. Bulletin No. 27-Statistics of the Mineral Production of Alabama for 1922. LIBRARY. 269

Georgia, Geological Survey of:

Bulletin No. 41—Iron Ore Deposits of Georgia. By R. H. Hazeltine,

Idaho Bureau of Mines and Geology:

Bulletin No. 6—Geology and Water Resources of the Goose Creek Basin, Cassia Co., Idaho.

Bulletin No. 8-Ground Water Supply of Moscow, Idaho.

Bulletin No. 9-Ground Water in Pahsimeroi Valley, Idaho.

Bulletin No. 10—Six Years' Work of the Idaho Bureau of Mines and Geology, 1919-1924.

Bulletin No. 11—Geology and Water Resources of the Bruneau River Basin, Owyhee Co., Idaho. By A. M. Piper.

Bulletin No. 12—Possibilities of Petroleum in Power and Oneida Counties, Idaho.

#### Illinois State Geological Survey:

Bulletin No. 45—Structural Reconnaissance of the Mississippi Valley Area from Old Monroe, Missouri, to Nauvoo, Illinois.

Report of Investigation No. 3—An Investigation of the Moulding Sand Resources of Illinois.

Missouri Bureau of Mines and Geology:

Biennial Report of the State Geologist for 1924.

#### Nevada:

Biennial Report of the State Inspector of Mines, 1923-1924.

North Carolina Geological and Economic Survey:

Biennial Report of the State Geologist and Director, 1921-1922.

Economic Paper No. 54—Water Power Investigation of Deep River. By Thorn Saville.

Circular No. 10—The Power Situation in North Carolina in 1924. By Thorn Saville.

Circular No. 11-Forest Fires and Taxation.

Economic Paper No. 55—The Mineral Industry of North Carolina from 1918 to 1923.

Biennial Report of the State Geologist, 1923-1924.

#### Oklahoma Geological Survey:

Circular No. 10—A Silurian-Devonian Oil Horizon in Southern Oklahoma. By G. D. Morgan.

Circular No. 11—Arkose of the Northern Arbuckle Area. By G. D. Morgan. Circular No. 12—Stratigraphic Position of the Franks and Seminole Formations of Oklahoma. By G. D. Morgan.

Bulletin No. 32—Geology of the Southern Ouchita Mts. of Oklahoma. By C. W. Honess.

Bulletin No. 33-Geology of Love County. By F. M. Bullard.

#### Virginia Geological Survey:

Bulletin No. 25—The Valley Coal Fields of Virginia. By M. R. Campbell,

#### Washington Geological Survey:

Bulletin No. 31-Lead Deposits of Pend Orielle and Stevens Counties.

West Virginia Geological Survey:

Mineral and Grant Counties. By D. B. Reger.

The Parliament of the Commonwealth of Australia:

Petroleum Prospects of the Kimberly District of Western Australia and Northern Territory.

#### Department of Mines, South Australia:

Mining Review, No. 40.

Memorias de la Real Academia de Ciences y Artes de Barcelona:

#### Vol. XVIII:

No. 10—Las Nubes Cosmicas y las Irregularidades en el Perido de Ciertas Estrellas Variables.

No. 11-Representacion Grafica de Espacious Superiores.

No. 12-La Riquesa en Metales Preciosos de la la Espana Antigue.

No. 13—Odonatos Nuevos o Interesantes.

No. 14-Nota Petrograpfica Sobre Algunas Rocas de la Provincia de Tarragona.

No. 15—Consideraciones sobre un neuvo Renacimiento.

No. 16-Marquinas Electriceas a Velocidad Variable.

#### Department of Mines, Canada:

Investigations of Fuels and Fuel Testing.

Investigations of Mineral Resources and the Mining Industry.

Investigations of Ceramics and Road Materials. Investigations in Ore Dressing and Metallurgy.

#### Dominion Fuel Board, Canada:

Coke as a Household Fuel in Central Canada. The Smoky River Coal Feld. By James McEvoy.

#### Geological Survey of England:

Special Memoirs on the Mineral Resources of Great Britain, Vol. VIII.

#### Geological Survey of Great Britain:

The Geology of the Country Around Wem.

#### Instituto Geologico de Mexico:

Num. 10-Las Publicaciones del Instituto.

Num. 40-Catalogo Sistematico de Especies Minerales de Mexico.

Num. 40-El Cerro de Mercado Durango.

#### Department of Mines, New South Wales:

Bulletin No. 10—Silica. By L. F. Harper. Bulletin No. 12—Coke. By L. F. Harper. Bulletin No. 14—Asbestos. By R. G. Haggett.

Bulletin No. 15—Diatomite. By E. J. Kenny.

Bulletin No. 7—Gold.

Bulletin No. 8—Aluminum, Alunite, and Bauxite.

Bulletin No. 11-Cadmium and Mercury.

Mineral Resources No. 32-The Coal Resources of the Douglas Park Area.

#### Department of Mines, Ontario:

Thirty-third Annual Report of the Ontario Department of Mines.

Report of the Department of Mines for the Fiscal Year ending March 31, 1924. Memoir No. 142-Preliminary Report on the Clay and Shale Deposits of Ontario.

Summary Report, 1923, Part B

Part C I Part C II

#### Geological Survey, Scotland:

The Pre-Tertiary Geology of Mull, Loch Aline and Oban.

#### Societies and Educational Institutions.

#### University of California:

Vol. 15, No. 5-Notes on the Occurrence of Mammalian Remains in the Pleistocene of Mexico, with a Description of a New Species of Capromeryx Mexicana. By E. L. Furlong.

#### Colorado College:

Publication No. 129-Notes on the Life History and Feeding Habits of the Spadefoot Toad of the Western Plains. By R. J. Gilmoare.

#### Columbia University:

Summer Session and Announcement.

#### University of Missouri:

Briquetting of Zinc Ores. By B. M. O'Harra.

Proceedings of the Academy of Natural Sciences of Philadelphia. Vol. LXXVI. Report of the U.S. National Museum for 1924.

#### Current Magazines on File.

For the convenience of persons wishing to consult the technical magazines in the reading room, a list of those on file is appended:

American Petroleum Institute, New York. Architect and Engineer, San Francisco. Arizona Mining Journal, Phoenix, Arizona. Asbestos, Philadelphia, Pennsylvania.

Brick and Clay Record, Chicago.

Bulletin, Union Oil Co., Los Angeles.

California Journal of Development, San Francisco.

Cement, Mill and Quarry, Chicago, Illinois.

Chemical Engineering and Mining Review, London, England.

Engineering and Mining Journal-Press, New York.

Explosives Engineer, Wilmington, Del. Financial Insurance News, Los Angeles, California.

Graphite, Jersey City.

Journal of Electricity and Western Industry, San Francisco.

Metallurgical and Chemical Engineering, New York.

Mine and Quarry, Chicago.

Mining and Engineering Record, Vancouver, B. C.

Mining and Oil Bulletin, Los Angeles.

Oil Age, Los Angeles.

Oil and Gas Journal, Tulsa, Oklahoma,

Oil and Gas News, Kansas City.

Oil News, Galesburg, Illinois.

Oildom, New York.

Oil, Paint and Drug Reporter, New York.

Oil Trade Journal, New York. Oil Weekly, Houston, Texas. Petroleum Age, New York. Petroleum Record, Los Angeles. Petroleum World, Los Angeles,

Queensland Government Mining Journal, Brisbane, Australia.

Rock Products, Chicago, Illinois.

Safety News, Industrial Accident Commission, San Francisco.

Salt Lake Mining Review, Salt Lake City, Utah. Southwest Builder and Contractor, Los Angeles.

Standard Oil Bulletin, San Francisco.

Stone, New York.

The Record, Associated Oil Company, San Francisco.

Through the Ages, Baltimore.

#### Newspapers.

The following papers are received and kept on file in the library:

Amador Dispatch, Jackson, Cal.

Arkansas Oil and Mineral News, Hot Springs National Park (Arkansas).

Barstow Printer, Barstow, Cal. Blythe Herald, Blythe, Cal.

Bridgeport Chronicle-Union, Bridgeport, Mono Co., Cal.

Calaveras Prospect, San Andreas, Cal. California Oil World, Los Angeles, Cal. Cloverdale Reveille, Cloverdale, Cal. Colusa Daily Sun, Colusa, Cal. Daily Commercial News, San Francisco, Cal.

Daily Midway Driller, Taft, Cal.

Del Norte Triplicate, Crescent City, Cal.

Exeter Sun, Exeter, Cal.

Gateway Gazette, Beaumont, Cal. Goldfield News, Goldfield, Nevada. Guerneville Times, Guerneville, Cal.

Healdsburg Enterprise, Healdsburg, Cal.

Humboldt Standard, Eureka, Cal. Inyo Independent, Independence, Cal. Inyo Register, Bishop, Cal. Ione Valley Echo, Ione, Cal. Lake County Bee, Lakeport, Cal. Mining and Financial Record, Denver, Colo. Mining Topics, Sacramento, Cal., and Unionville, Nev. Mountain Democrat, Placerville, Cal. Mountain Messenger, Downieville, Cal. Nevada Mining Press, Reno, Nevada. Oatman Mining News, Oatman, Arizona. Oregon Observer, Grants Pass, Oregon. Oroville Daily Register, Oroville, Cal. Petroleum Reporter, Taft, Cal. Placer Herald, Auburn, Cal. Plumas Independent, Quincy, Cal. Plumas National Bulletin, Quincy, Cal. Randsburg Times, Randsburg, Cal. San Diego News, San Diego, Cal. Shasta Courier, Redding, Cal. Siskiyou News, Yreka, Cal. Stockton Record, Stockton, Cal. Tuolumne Prospector, Tuolumne, Cal. Ventura Daily Post, Ventura, Cal. Weekly Trinity Journal, Weaverville, Cal. Western Sentinel, Etna Mills, Cal.



## PRODUCERS AND CONSUMERS.

The producer and consumer of mineral products are mutually dependent upon each other for their prosperity, and one of the most direct aids rendered by the Bureau to the mining industry in the past has been that of bringing producers and consumers into direct touch with each other.

This work has been carried on largely by correspondence, supplemented by personal consultation. Lists of buyers of all the commercial minerals produced in California have been made available to producers upon request, and likewise the owners of undeveloped deposits of various minerals, and producers of them, have been made known to those looking for raw mineral products.

When the publication of MINING IN CALIFORNIA was on a monthly basis, current inquiries from buyers and sellers were summarized and lists of mineral products or deposits 'wanted' or 'for sale' included in

each issue.

It is important that inquiries of this nature reach the mining public as soon as possible and in order to avoid the delay incident to the present quarterly publication of MINING IN CALIFORNIA, these lists are now issued monthly in the form of a mimeographed sheet under the title of 'Commercial Mineral Notes.'

#### EMPLOYMENT SERVICE.

Following the establishment of the Mining Division branch offices in 1919, a free technical employment service was offered as a mutual aid to mine operators and technical men for the general benefit of the mineral industry.

Briefly summarized, men desiring positions are registered, the cards containing an outline of the applicant's qualifications, position wanted, salary desired, etc., and as notices of 'positions open' are received, the names and addresses of all applicants deemed qualified are sent to the prospective employer for direct negotiations.

Telephone and telegraphic communications are also given immediate

attention.

The Bureau registers technical men, or those qualified for supervisory positions, and vacancies of like nature, only, as no attempt will be made

to supply common mine and mill labor.

A list of current applications for positions and 'positions open' is carried in each issue. Notices are designated by a key number, and the name and address corresponding to any number will be supplied upon request, without delay or charge of any kind. If desired, recommendations may be filed with an application, but copies only should be sent to the Bureau, to avoid possible loss. Registration cards for the use of both prospective employers and employees may be obtained at any office of the Bureau upon request, and a cordial invitation is extended to the industry to make free use of the facilities afforded.

#### POSITIONS WANTED.

31-6 Mining Engineer; manager or mine foreman. Eighteen years' experience in South Africa. Age 40. Single. References. Salary wanted, \$250. 31 - 7Mine Surveying. Four years' surveying experience. Age 33.

References. Salary wanted \$150 and expenses.

Shift Boss. Twenty-eight years' experience in Transvaal, South Africa.

Age 44. References. Salary open. 31-8

31-9 Mine Office Work. One year's experience as clerk and time-keeper. Age 23. Married. References. Salary wanted, \$125.

Mining Engineer. Six and one-half years' experience as engineer, miner, leaser, and cyanide man. Age 37. Married. References. Salary 31-10 wanted, \$175.

31-11 Surveyor or outside foreman. Five years' experience as labor foreman and engineer. Age 42. Married. References. Salary open. Mining or Oil Work. Russian Engineer. Speaks good English. Lots of 31 - 12

experience in Russian mines, mills, and oil field geology.

31 - 13Assistant Geologist. Three years' study at Minnesota and Iowa Universities. General and advanced geology, economic geology, mineralogy, paleontology, plane-tabling, surveying, and field trips. Age 24. Married, References. Salary wanted, \$150.

# PUBLICATIONS OF THE CALIFORNIA STATE MINING BUREAU.

During the past forty-four years, in carrying out the provisions of the organic act creating the California State Mining Bureau, there have been published many reports, bulletins and maps which go to make up a library of detailed information on the mineral industry of the state, a large part of which could not be duplicated from any other source.

One feature that has added to the popularity of the publications is that many of them have been distributed without cost to the public, and even the more elaborate ones have been sold at a price which barely covers the cost of printing.

Owing to the fact that funds for the advancing of the work of this department have often been limited, many of the reports and bulletins mentioned were printed in limited editions which are now entirely

exhausted.

Copies of such publications are available, however, in the Bureau's offices in the Ferry Building, San Francisco; Pacific Finance Building, Los Angeles; in Sacramento; Santa Maria; Santa Paula; Coalinga; Taft; Bakersfield. They may also be found in many public, private and technical libraries in California and other states, and foreign countries.

A catalog of all publications of the Bureau, from 1880 to 1917,

giving a synopsis of their contents, is issued as Bulletin No. 77.

Publications in stock may be obtained by addressing any of the offices of the State Mining Bureau and enclosing the requisite amount in the case of publications that have a list price. The Bureau is authorized to receive only coin, stamps or money orders, and it will be appreciated if remittance is made in this manner rather than by personal check.

The prices noted include delivery charges to all parts of the United States. Money orders should be made payable to the State Mining

Bureau.

#### REPORTS.

Asterisks (**) indicate the publication is out of print.	Price
**First Annual Report of the State Mineralogist, 1880, 43 pp. Henry G.	
**Second Annual Report of the State Mineralogist, 1882, 514 pp., 4 illustra-	
tions, 1 map. Henry G. Hanks	
**Third Annual Report of the State Mineralogist, 1883, 111 pp., 21 illustra-	
tions. Henry G. Hanks	
**Fourth Annual Report of the State Mineralogist, 1884, 410 pp., 7 illustra-	
tions. Henry G. Hanks	
**Fifth Annual Report of the State Mineralogist, 1885, 234 pp., 15 illustra-	
tions, 1 geological map. Henry G. Hanks	
**Sixth Annual Report of the State Mineralogist, Part I, 1886, 145 pp., 3	
illustrations, 1 map. Henry G. Hanks	
**Part II, 1887, 222 pp., 36 illustrations. William Irelan, Jr.	
**Seventh Annual Report of the State Mineralogist, 1887, 315 pp. William	
Irelan, Jr.	
**Eighth Annual Report of the State Mineralogist, 1888, 948 pp., 122 illustra-	
tions. William Irelan, Jr.	
**Ninth Annual Report of the State Mineralogist, 1889, 352 pp., 57 illustra-	
tions, 2 maps. William Irelan, Jr.	

## REPORTS—Continued.

Asterisks (**) indicate the publication is out of print.	77-1
**Tenth Annual Report of the State Mineralogist, 1890, 983 pp., 179 illustrations, 10 maps. William Irelan, Jr	Price
Eleventh Report (First Biennial) of the State Mineralogist, for the two years ending September 15, 1892, 612 pp., 73 illustrations, 4 maps.	\$1.00
**Twelfth Report (Second Biennial) of the State Mineralogist, for the two years ending September 15, 1894, 541 pp., 101 illustrations, 5 maps.	φ1.00
J. J. Crawford**Thirteenth Report (Third Biennial) of the State Mineralogist, for the two years ending September 15, 1896, 726 pp., 93 illustrations, 1 map.	
J. J. Crawford Chapters of the State Mineralogist's Report, Biennial Period, 1913-1914, Fletcher Hamilton:	
**Mines and Mineral Resources, Amador, Calaveras and Tuolumne Counties, 172 pp., paper	
Sonoma and Yolo Counties, 208 pp., paperMines and Mineral Resources, Del Norte, Humboldt, and Mendocino Counties, 59 pp., paper	.50
**Mines and Mineral Resources, Fresno, Kern, Kings, Madera, Mariposa, Merced, San Joaquin and Stanislaus Counties, 220 pages, paper Mines and Mineral Resources of Imperial and San Diego Counties,	
**Mines and Mineral Resources, Shasta, Siskiyou and Trinity Counties,	.35
Fourteenth Report of the State Mineralogist, for the Biennial Period 1913-1914, Fletcher Hamilton, 1915:	
A General Report on the Mines and Mineral Resources of Amador, Calaveras, Tuolumne, Colusa, Glenn, Lake, Marin, Napa, Solano, Sonoma, Yolo, Del Norte, Humboldt, Mendocino, Fresno, Kern, Kings, Madera, Mariposa, Merced, San Joaquin, Stanislaus, San Diego, Imperial, Shasta, Siskiyou, and Trinity Counties, 974 pp., 275 illustrations, cloth	2.00
Chapters of the State Mineralogist's Report, Biennial Period, 1915-1916, Fletcher Hamilton: Mines and Mineral Resources, Alpine, Inyo and Mono Counties, 176 pp.,	
paperSame, including geological map of Inyo CountyMines and Mineral Resources, Butte, Lassen, Modoc, Sutter, and Tehama	.65 1.25
Counties, 91 pp., paperMines and Mineral Resources, El Dorado, Placer, Sacramento, and Yuba Counties, 198 pp., paper	.50 .65
Mines and Mineral Resources, Monterey, San Benito, San Luis Obispo, Santa Barbara, and Ventura Counties, 183 pp., paper Mines and Mineral Resources, Los Angeles, Orange, and Riverside Counties,	.65
136 pp., paper Mines and Mineral Resources, San Bernardino and Tulare Counties, 186 pp.,	.50
Fifteenth Report of the State Mineralogist, for the Biennial Period 1915–1916, Fletcher Hamilton, 1917:	.65
A General Report on the Mines and Mineral Resources of Alpine, Inyo, Mono, Butte, Lassen, Modoc, Sutter, Tehama, Placer, Sacramento, Yuba, Los Angeles, Orange, Riverside, San Benito, San Luis Obispo, Santa Barbara, Ventura, San Bernardino and Tulare Counties, 990 pp.,	0.75
413 illustrations, clothChapters of the State Mineralogist's Report, Biennial Period 1917–1918,  Fletcher Hamilton:	3.75
Mines and Mineral Resources of Nevada County, 270 pp., paper	.75
Mines and Mineral Resources of Plumas County, 188 pp., paper Mines and Mineral Resources of Sierra County, 144 pp., paper	.50
Seventeenth Report of the State Mineralogist, 1920, Mining in California during 1920, Fletcher Hamilton; 562 pp., 71 illustrations, cloth	1.75

## REPORTS—Continued.

Asterisks (**) indicate the publication is out of print.	
Eighteenth Report of the State Mineralogist, 1922, Mining in California, Fletcher Hamilton. Chapters published monthly beginning with Jan-	Price
uary, 1922:	
**January, **February, March, April, May, June, July, August, September, October, November, December, 1922	Free
Fletcher Hamilton and Lloyd L. Root. January, February, March, September, 1923	Free
Chapters of Twentieth Report of the State Mineralogist, 'Mining in California,' Lloyd L. Root. Published quarterly. January, April, July, October, 1924, per copy	\$0.25
Chapters of Twenty-first Report of State Mineralogist, Mining in California, Lloyd L. Root. Published quarterly. January, 1925	.25
Subscription, \$1.00 in advance (by calendar year, only).  Chapters of State Oil and Gas Supervisor's Report:  Summary of Operations—California Oil Fields, July, 1918, to March, 1919	
(one volume)Summary of Operations—California Oil Fields. Published monthly, begin-	Free
ning April, 1919:  **April, **May, June, **July, **August, **September, **October, November,	Enco
**December, 1919 January, February, March, April, **May, June, July, **August, September, October, November, December, 1920	Free
January, **February, **March, **April, May, June, **July, August, **September, **October, **November, **December, 1921	Free
January, February, March, April, May, June, July, August, September, October, November, December, 1922 January, February, March, April, May, June, July, August, September,	Free
October, November, December, 1923 January, February, March, April, May, June, July, August, September, 1924	Free
BULLETINS.	
BULLETINS.  Asterisks (**) indicate the publication is out of print.	
Asterisks (**) indicate the publication is out of print.  **Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrations	
Asterisks (**) indicate the publication is out of print.  **Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrations.  **Bulletin No. 2. Methods of Mine Timbering, by W. H. Storms. 1894, 58 pp., 75 illustrations.	
**Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrations.  **Bulletin No. 2. Methods of Mine Timbering, by W. H. Storms. 1894, 58 pp., 75 illustrations.  **Bulletin No. 3. Gas and Petroleum Yielding Formations of Central Valley of California, by W. L. Watts. 1894, 100 pp., 13 illustrations, 4 maps.  **Bulletin No. 4. Catalogue of Californian Fossils, by J. G. Cooper, 1894, 73 pp., 67 illustrations. (Part I was published in the Seventh Annual	
Asterisks (**) indicate the publication is out of print.  **Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrations.  **Bulletin No. 2. Methods of Mine Timbering, by W. H. Storms. 1894, 58 pp., 75 illustrations.  **Bulletin No. 3. Gas and Petroleum Yielding Formations of Central Valley of California, by W. L. Watts. 1894, 100 pp., 13 illustrations, 4 maps.  **Bulletin No. 4. Catalogue of Californian Fossils, by J. G. Cooper, 1894, 73 pp., 67 illustrations. (Part I was published in the Seventh Annual Report of the State Mineralogist, 1887.)  **Bulletin No. 5. The Cyanide Process, 1894, by Dr. A. Scheidel. 140 pp.,	
Asterisks (**) indicate the publication is out of print.  **Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrations.  **Bulletin No. 2. Methods of Mine Timbering, by W. H. Storms. 1894, 58 pp., 75 illustrations.  **Bulletin No. 3. Gas and Petroleum Yielding Formations of Central Valley of California, by W. L. Watts. 1894, 100 pp., 13 illustrations, 4 maps.  **Bulletin No. 4. Catalogue of Californian Fossils, by J. G. Cooper, 1894, 73 pp., 67 illustrations. (Part I was published in the Seventh Annual Report of the State Mineralogist, 1887.)  **Bulletin No. 5. The Cyanide Process, 1894, by Dr. A. Scheidel. 140 pp., 46 illustrations  Bulletin No. 6. California Gold Mill Practices, 1895, by E. B. Preston,	
Asterisks (**) indicate the publication is out of print.  **Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrations	
Asterisks (**) indicate the publication is out of print.  **Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrations.  **Bulletin No. 2. Methods of Mine Timbering, by W. H. Storms. 1894, 58 pp., 75 illustrations.  **Bulletin No. 3. Gas and Petroleum Yielding Formations of Central Valley of California, by W. L. Watts. 1894, 100 pp., 13 illustrations, 4 maps.  **Bulletin No. 4. Catalogue of Californian Fossils, by J. G. Cooper, 1894, 73 pp., 67 illustrations. (Part I was published in the Seventh Annual Report of the State Mineralogist, 1887.)  **Bulletin No. 5. The Cyanide Process, 1894, by Dr. A. Scheidel. 140 pp., 46 illustrations  Bulletin No. 6. California Gold Mill Practices, 1895, by E. B. Preston, 85 pp., 46 illustrations  **Bulletin No. 7. Mineral Production of California, by Counties for the year 1894, by Charles G. Yale. Tabulated sheet_  **Bulletin No. 8. Mineral Production of California, by Counties for the year 1895, by Charles G. Yale. Tabulated sheet_	
**Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrations	.50
Asterisks (**) indicate the publication is out of print.  **Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrations.  **Bulletin No. 2. Methods of Mine Timbering, by W. H. Storms. 1894, 58 pp., 75 illustrations.  **Bulletin No. 3. Gas and Petroleum Yielding Formations of Central Valley of California, by W. L. Watts. 1894, 100 pp., 13 illustrations, 4 maps.  **Bulletin No. 4. Catalogue of Californian Fossils, by J. G. Cooper, 1894, 73 pp., 67 illustrations. (Part I was published in the Seventh Annual Report of the State Mineralogist, 1887.)  **Bulletin No. 5. The Cyanide Process, 1894, by Dr. A. Scheidel. 140 pp., 46 illustrations  Bulletin No. 6. California Gold Mill Practices, 1895, by E. B. Preston, 85 pp., 46 illustrations.  **Bulletin No. 7. Mineral Production of California, by Counties for the year 1894, by Charles G. Yale. Tabulated sheet.  **Bulletin No. 8. Mineral Production of California, by Counties for the year 1895, by Charles G. Yale. Tabulated sheet.  **Bulletin No. 9. Mine Drainage, Pumps, etc., by Hans C. Behr. 1896, 210 pp., 206 illustrations.  **Bulletin No. 10. A bibliography Relating to the Geology, Palæontology and Mineral Resources of California, by Anthony W. Vogdes. 1896, 121 pp.  **Bulletin No. 11. Oil and Gas Yielding Formations of Los Angeles, Ventura and Santa Barbara counties, by W. L. Watts. 1897, 94 pp., 6 maps,	.50
**Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrations	.50
Asterisks (**) indicate the publication is out of print.  **Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrations.  **Bulletin No. 2. Methods of Mine Timbering, by W. H. Storms. 1894, 58 pp., 75 illustrations.  **Bulletin No. 3. Gas and Petroleum Yielding Formations of Central Valley of California, by W. L. Watts. 1894, 100 pp., 13 illustrations, 4 maps.  **Bulletin No. 4. Catalogue of Californian Fossils, by J. G. Cooper, 1894, 73 pp., 67 illustrations. (Part I was published in the Seventh Annual Report of the State Mineralogist, 1887.)  **Bulletin No. 5. The Cyanide Process, 1894, by Dr. A. Scheidel. 140 pp., 46 illustrations  Bulletin No. 6. California Gold Mill Practices, 1895, by E. B. Preston, 85 pp., 46 illustrations.  **Bulletin No. 7. Mineral Production of California, by Counties for the year 1894, by Charles G. Yale. Tabulated sheet.  **Bulletin No. 8. Mineral Production of California, by Counties for the year 1895, by Charles G. Yale. Tabulated sheet.  **Bulletin No. 9. Mine Drainage, Pumps, etc., by Hans C. Behr. 1896, 210 pp., 206 illustrations.  **Bulletin No. 10. A bibliography Relating to the Geology, Palæontology and Mineral Resources of California, by Anthony W. Vogdes. 1896, 121 pp.  **Bulletin No. 11. Oil and Gas Yielding Formations of Los Angeles, Ventura and Santa Barbara counties, by W. L. Watts. 1897, 94 pp., 6 maps,	.50

#### BULLETINS-Continued.

BULLETINS—Continued.	
Asterisks (**) indicate the publication is out of print.	
**Bulletin No. 14. Mineral Production of California, by Counties for 1898, by Charles G. Yale	Price
**Bulletin No. 15. Map of Oil City Fields, Fresno County, by John H.  Means, 1899	
**Bulletin No. 16. The Genesis of Petroleum and Asphaltum in California, by A. S. Cooper. 1899, 39 pp., 29 illustrations	
**Bulletin No. 17. Mineral Production of California, by Counties for 1899,	
**Bulletin No. 18. Mother Lode Region of California, by W. H. Storms. 1900, 154 pp., 49 illustrations	~~~
**Bulletin No. 19. Oil and Gas Yielding Formations of California, by W. L. Watts. 1900, 236 pp., 60 illustrations, 8 maps	
**Bulletin No. 20. Synopsis of General Report of State Mining Bureau, by W. L. Watts. 1901, 21 pp. This bulletin Collains a brief statement	
of the progress of the mineral industry in California for the four years ending December, 1899*Bulletin No. 21. Mineral Production of California by Counties, by Charles	
G. Yale. 1900. Tabulated sheet	
Charles G. Yale. 1900. Tabulated sheet.  Bulletin No. 23. The Copper Resources of California, by P. C. DuBois,	
F. M. Anderson, J. H. Tibbits and G. A. Tweedy. 1902, 282 pp., 69 illustrations, and 9 maps.	\$0.50
**Bulletin No. 24. The Saline Deposits of California, by G. E. Bailey. 1902, 216 pp., 99 illustrations, 5 maps	φυ.ου
**Bulletin No. 25. Mineral Production of California, by Counties, for 1901, by Charles G. Yale. Tabulated sheet	~~~
**Bulletin No. 26. Mineral Production of California for the past Fifteen Years, by Charles G. Yale. 1902. Tabulated sheet	
**Bulletin No. 27. The Quicksilver Resources of California, by William Forstner. 1903, 273 pp., 144 illustrations, 8 maps	00 = 00 00
**Bulletin No. 28. Mineral Production of California, for 1902, by Charles G. Yale. Tabulated sheet	
**Bulletin No. 29. Mineral Production of California for Sixteen Years, by Charles G. Yale. 1903. Tabulated sheet.	
**Bulletin No. 30. Bibliography Relating to the Geology, Palæontology, and Mineral Resources of California, by A. W. Vogdes. 1903, 290 pp*Bulletin No. 31. Chemical Analyses of California Petroleum, by H. N.	
Cooper. 1904. Tabulated sheet***Bulletin No. 32. Production and Use of Petroleum in California, by Paul	
W. Prutzman. 1904, 230 pp., 116 illustrations, 14 maps	
by Charles G. Yale. Tabulated sheet**Bulletin No. 34. Mineral Production of California for Seventeen Years,	
by Charles G. Yale. 1904. Tabulated sheet**Bulletin No. 35. Mines and Minerals of California, by Charles G. Yale.	
1904, 55 pp., 20 county maps. Relief map of California**Bulletin No. 36. Gold Dredging in California, by J. E. Doolittle. 1905,	
120 pp., 66 illustrations, 3 maps**Bulletin No. 37. Gems, Jewelers' Materials, and Ornamental Stones of	.25
California, by George F. Kunz. 1905, 168 pp., 54 illustrations**Bulletin No. 38. Structural and Industrial Materials of California, by Wm. Forstner, T. C. Hopkins, C. Naramore and L. H. Eddy. 1906,	.20
**Bulletin No. 39. Mineral Production of California, by Counties, for 1904, by Charles G. Yale. Tabulated sheet	
**Bulletin No. 40. Mineral Production of California for Eighteen Years, by Charles G. Yale. 1905. Tabulated sheet	
**Bulletin No. 41. Mines and Minerals of California, for 1904, by Charles G. Yale, 1905, 54 pp., 20 county maps	
**Bulletin No. 42. Mineral Production of California, by Counties, 1905, by Charles G. Yale. Tabulated sheet	

## BULLETINS-Continued.

Asterisks (**) indicate the publication is out of print.	Dulas
**Bulletin No. 43. Mineral Production of California for Nineteen Years,	Price
by Charles G. Yale, Tabulated sheet**Bulletin No. 44, California Mines and Minerals for 1905, by Charles G.	
Vale 1907 31 pp 20 county mans	
**Bulletin No. 45. Auriferous Black Sands of California, by J. A. Edman. 1907. 10 pp.	
Bulletin No. 46. General Index of Publications of the California State	\$0.30
Mining Bureau, by Charles G. Yale. 1907, 54 pp**Bulletin No. 47. Mineral Production of California, by Counties, 1906,	φυ.ου
by Charles G. Yale. Tabulated sheet*Bulletin No. 48. Mineral Production of California for Twenty Years.	
1906. by Charles G. Yale	
**Bulletin No. 49. Mines and Minerals of California for 1906, by Charles G. Yale, 34 pp	
Bulletin No. 50. The Copper Resources of California, 1908, by A. Hausmann, J. Kruttschnitt, Jr., W. E. Thorne and J. A. Edman, 366 pp.,	
74 illustrations (Revised edition)	1.00
**Bulletin No. 51. Mineral Production of California, by Counties, 1907, by D. H. Walker, Tabulated sheet	
**Bulletin No. 52. Mineral Production of California for Twenty-one Years,	
1907, by D. H. Walker. Tabulated sheet*Bulletin No. 53. Mineral Production of California for 1907, with County	
Maps, by D. H. Walker, 62 pp. **Bulletin No. 54. Mineral Production of California, by Counties, by D. H.	
Walker, 1908. Tabulated sheet	
**Bulletin No. 55. Mineral Production of California for Twenty-two Years, by D. H. Walker, 1908. Tabulated sheet	
**Bulletin No. 56. Mineral Production for 1908, with County Maps and	
Mining Laws of California, by D. H. Walker. 78 pp.  **Bulletin No. 57. Gold Dredging in California, by W. B. Winston and	
Chas. Janin. 1910, 312 pp., 239 illustrations and 10 maps	
Walker, 1909. Tabulated sheet	
**Bulletin No. 59. Mineral Production of California for Twenty-three Years, by D. H. Walker, 1909. Tabulated sheet	
**Bulletin No. 60. Mineral Production for 1909, County Maps and Mining	
Laws of California, by D. H. Walker. 94 pp.  **Bulletin No. 61. Mineral Production of California, by Counties for 1910,	
by D. H. Walker. Tabulated sheet**Bulletin No. 62. Mineral Production of California for Twenty-four Years,	
by D. H. Walker, 1910. Tabulated sheet	
**Bulletin No. 63. Petroleum in Southern California, by P. W. Prutzman. 1912, 430 pp., 41 illustrations, 6 maps	
**Bulletin No. 64. Mineral Production for 1911, by E. S. Boalich. 49 pp	
**Bulletin No. 65. Mineral Production for 1912, by E. S. Boalich. 64 pp **Bulletin No. 66. Mining Laws of the United States and California. 1914,	
89 pp.  **Bulletin No. 67. Minerals of California, by Arthur S. Eakle. 1914,	
226 pp	
**Bulletin No. 68. Mineral Production for 1913, with County Maps and Mining Laws, by E. S. Boalich, 160 pp	
**Bulletin No. 69. Petroleum Industry of California, with Folio of Maps	
(18 by 22), by R. P. McLaughlin and C. A. Waring. 1914, 519 pp., 13 illustrations, 83 figs. [18 plates in accompanying folio.]	
**Bulletin No. 70. Mineral Production for 1914, with County Maps and Mining Laws, 184 pp.	
**Bulletin No. 71. Mineral Production for 1915, with County Maps and	
Mining Laws, by Walter W. Bradley. 193 pp., 4 illustrationsBulletin No. 72. The Geologic Formations of California, by James Perrin	
Smith. 1916, 47 pp	.25
Reconnaissance Geologic Map (of which, Bulletin 72 is explanatory), in 23 colors. Scale: 1 inch equals 12 miles. Mounted	2.50

## BULLETINS—Continued.

Asterisks (**) indicate the publication is out of print.	
**Bulletin No. 73. First Annual Report of the State Oil and Gas Supervisor of California, for the fiscal year 1915-16, by R. P. McLaughlin.	Price
278 pp., 26 illustrations	Free
**Bulletin No. 75. United States and California Mining Laws, 1917. 115 pp.,	
Bulletin No. 76. Manganese and Chromium in California, by Walter W. Bradley, Emile Huguenin, C. A. Logan, W. B. Tucker and C. A.	
Waring, 1918. 248 pp., 51 illustrations, 5 maps, paper	\$0.50 Free
Bulletin No. 78. Quicksilver Resources of California, with a Section on Metallurgy and Ore-Dressing, by Walter W. Bradley, 1918. 389 pp., 77 photographs and 42 plates (colored and line cuts), cloth	1.50
Bulletin No. 79. Magnesite in California. (In preparation.) Bulletin No. 80. Tungsten, Molybdenum and Vanadium in California.	
Bulletin No. 81. Foothill Copper Belt of California. (In preparation.) **Bulletin No. 82. Second Annual Report of the State Oil and Gas Supervisor, for the fiscal year 1916-1917, by R. P. McLaughlin, 1918. 412 pp.,	
31 illustrations, cloth	
**Bulletin No. 84. Third Annual Report of the State Oil and Gas Supervisor, for the fiscal year 1917-1918, by R. P. McLaughlin, 1918.	Free
**Bulletin No. 85. Platinum and Allied Metals in California, by C. A. Logan, 1919. 10 photographs, 4 plates, 120 pp., paper	.50
Bulletin No. 86. California Mineral Production for 1918, with County Maps, by Walter W. Bradley, 1919. 212 pp., paper	Free
**Bulletin No. 87. Commercial Minerals of California, with notes on their uses, distribution, properties, ores, field tests, and preparation for market, by W. O. Castello, 1920. 124 pp., paper	
Bulletin No. 88. California Mineral Production for 1919, with County Maps, by Walter W. Bradley, 1920. 204 pp., paper**Bulletin No. 89. Petroleum Resources of California, with Special Reference	Free
to Unproved Areas, by Lawrence Vander Leck, 1921. 12 figures, 6 photographs, 6 maps in pocket, 186 pp., cloth	1.25
Bulletin No. 90. California Mineral Production for 1920, with County Maps, by Walter W. Bradley, 1921. 218 pp., paperBulletin No. 91. Minerals of California, by Arthur S. Eakle, 1923, 328 pp.,	Free
Bulletin No. 92. Gold Placers of California, by Chas. S. Haley, 1923. 167	1.00
pp., 36 photographs and 7 plates (colored and line cuts, also geologic map), cloth	1.50 .50
Bulletin No. 93. California Mineral Production for 1922, by Walter W. Bradley, 1923	Free
Bulletin No. 94. California Mineral Production for 1923, by Walter W. Bradley, 1924	Fre
PRELIMINARY REPORTS.	
Asterisks (**) indicate the publication is out of print.	
**Preliminary Report No. 1. Notes on Damage by Water in California Oil Fields, December, 1913. By R. P. McLaughlin. 4 pp	
**Preliminary Report No. 2. Notes on Damage by Water in California Oil Fields, March, 1914. By R. P. McLaughlin. 4 ppPreliminary Report No. 3. Manganese and Chromium, 1917. By E. S.	
Boalich. 32 pp.	

## PRELIMINARY REPORTS-Continued.

Asterisks (**) indicate the publication is out of print.		
Preliminary Report No. 4. Tungsten, Molybdenum and Vanadium. By E. S. Boalich and W. O. Castello, 1918. 34 pp. PaperPreliminary Report No. 5. Antimony, Graphite, Nickel, Potash, Strontium	Price Free	
and Tin. By E. S. Boalich and W. O. Castello, 1918. 44 pp. Paper_Preliminary Report No. 6. A Review of Mining in California During 1919.	Free Free	
**Preliminary Report No. 7. The Clay Industry in California. By E. S. Boalich, W. O. Castello, E. Huguenin, C. A. Logan, and W. B. Tucker, 1920. 102 pp. 24 illustrations. Paper		
1921, with Notes on the Outlook for 1922. Fletcher Hamilton, 1922. 68 pp. Paper		
MISCELLANEOUS PUBLICATIONS.		
Asterisks (**) indicate the publication is out of print.		
**First Annual Catalogue of the State Museum of California, being the collection made by the State Mining Bureau during the year ending April 16,		
1881. 350 pp**Catalogue of books, maps, lithographs, photographs, etc., in the library of		
the State Mining Bureau at San Francisco, May 15, 1884. 19 pp**Catalogue of the State Museum of California, Volume II, being the collec-		
tion made by the State Mining Bureau from April 16, 1881, to May 5, 1884. 220 pp		
**Catalogue of the State Museum of California, Volume III, being the collection made by the State Mining Bureau from May 15, 1884, to March 31,		
**Catalogue of the State Museum of California, Volume IV, being the collection made by the State Mining Bureau from March 30, 1887, to August		
20, 1890. 261 pp**Catalogue of the Library of the California State Mining Bureau, September		
1, 1892. 149 pp		
**Catalogue of West North American and Many Foreign Shells with Their Geographical Ranges, by J. G. Cooper. Printed for the State Mining Bureau, April, 1894		
**Report of the Board of Trustees for the four years ending September, 1900.		
15 pp. PaperBulletin. Reconnaissance of the Colorado Desert Mining District. By		
Stephen Bowers, 1901. 19 pp. 2 illustrations. Paper	Free	
Commercial Mineral Notes. A monthly mimeographed sheet, beginning April, 1923	Free	
API11) AUGU	Fice	
MAPS.		
Registers of Mines With Maps.		
Asterisks (**) indicate out of print.		
**Register of Mines, with Map, Amador County		
**Register of Mines, with Map, Butte County*Register of Mines, with Map, Calaveras County		
**Register of Mines, with Map, El Dorado County		
**Register of Mines, with Map, Inyo County		
**Register of Mines, with Map, Kern County  **Register of Mines, with Map, Lake County		
**Register of Mines, with Map, Mariposa County		
**Register of Mines, with Map. Nevada County		
**Register of Mines, with Map, Placer County		
**Register of Mines, with Map, Plumas County **Register of Mines, with Map, San Bernardino County		
**Register of Mines, with Map, San Diego County		
Register of Mines, with Map, Santa Barbara County		

## MAPS—Continued.

Asterisks (**) indicate the publication is out of print.		
**Posinton of Miner with Man Sharts Grants	Price	
**Register of Mines, with Map, Shasta County **Register of Mines, with Map, Sierra County		
**Register of Mines, with Map, Siskiyou County		
**Register of Mines, with Map, Trinity County		
**Register of Mines, with Map, Tuolung County		
Register of Mines, with Map, Yuba County		
Designation of Oil Wells with Man T. A. I. Oil		
The state of the s		
OTHER MAPS.		
Asterisks (**) indicate the publication is out of print,		
**Map of California, Showing Mineral Deposits (50 x 60 in.)—		
Map of Forest Reserves in California— Mounted	<b>en</b> 50	
**Unmounted	\$0.50	
**Mineral and Relief Map of California		
**Map of El Dorado County, Showing Boundaries, National Forests		
**Map of Madera County, Showing Boundaries, National Forests		
**Map of Placer County, Showing Boundaries, National Forests		
**Map of Shasta County, Showing Boundaries, National Forests		
**Map of Sierra County, Showing Boundaries, National Forests		
**Map of Siskiyou County, Showing Boundaries, National Forests		
**Map of Tuolumne County, Showing Boundaries, National Forests		
**Map of Mother Lode Region		
**Map of Desert Region of Southern California		
Map of Minaret District, Madera County	.20	
Map of Copper Deposits in California	.05	
**Map of Calaveras County*Map of Plumas County	.25	
**Map of Trinity County	.20	
Map of Tuolumne County	.25	
Geological Map of Inyo County. Scale 1 inch equals 4 miles	.60	
Map of California accompanying Bulletin No. 89, showing generalized classi-		
fication of land with regard to oil possibilities. Map only, without		
	.25	
Geological Map of California, 1916. Scale 1 inch equals 12 miles. As		
accurate and up-to-date as available data will permit as regards topog-		
raphy and geography. Shows railroads, highways, post offices and other		
towns. First geological map that has been available since 1892, and		
shows geology of entire state as no other map does. Geological details	2.50	
lithographed in 23 colors, MountedTopographic Map of Sierra Nevada Gold Belt, showing distribution of	2.50	
auriferous gravels. In 4 colors	.50	
autherous gravers. In a colors	.50	
OIL FIELD MAPS.		
These maps are revised from time to time as development work		
advances and ownerships change.	~~	
Map No. 1—Sargent, Santa Clara County	.50 .75	
Map No. 2—Santa Maria, including Cat Canyon and Los Alamos	.75	
Map No. 4—Whittier-Fullerton, including Olinda, Brea Canyon, Puente	.10	
Hills, East Coyote and Richfield.	.75	
Map No. 5—Whittier-Fullerton, including Whittier, West Coyote, and		
Montebello	.75	
Map No. 6—Salt Lake, Los Angeles County	.75	
Map No. 7—Sunset and San Emido and Kern County	.75	
Map No. 8—South Midway and Buena Vista Hills, Kern County	.75	
Map No. 9-North Midway and McKittrick, Kern County	.75	
Map No. 10—Belridge and McKittrick, Kern County	.75	
Map No. 11—Lost Hills and North Belridge, Kern County	.75	
Map No. 12—Devils Den, Kern County	.75	

#### OIL FIELD MAPS-Continued.

		Price
Map	No. 13—Kern River, Kern County	\$0.75
	No. 14—Coalinga, Fresno County	1.00
	No. 15—Elk Hills, Kern County	.75
Map	No. 16-Ventura-Ojai, Ventura County	.75
	No. 17-Santa Paula-Sespe Oil Fields, Ventura County	.75
Map	No. 18-Piru-Simi-Newhall Oil Fields	.75
Map	No. 19-Arroyo Grande, San Luis Obispo County	.75
Map	No. 20—Long Beach Oil Field	1.00
Map	No. 21-Portion of District 4, Showing Boundaries of Oil Fields, Kern	
	and Kings counties	.75
Map	No. 22-Portion of District 3, Showing Oil Fields, Santa Barbara	
	County	.75
Map	No. 23-Portion of District 2, Showing Boundaries of Oil Fields,	
	Ventura County	.75
Map	No. 24-Portion of District 1, Showing Boundaries of Oil Fields, Los	
	Angeles and Orange counties	.75
Map	No. 26—Huntington Beach Oil Field	.75
	No. 27—Santa Fe Springs Oil Field	.75
	No. 28—Torrance, Los Angeles County	.75
Map	No. 29—Dominguez, Los Angeles County	
Map	No. 30—Rosecrans, Los Angeles County	1.00

#### DETERMINATION OF MINERAL SAMPLES.

Samples (limited to three at one time) of any mineral found in the state may be sent to the Bureau for identification, and the same will be classified free of charge. No samples will be determined if received from points outside the state. It must be understood that no assays, or quantitative determinations will be made. Samples should be in lump form if possible, and marked plainly with name of sender on outside of package, etc. No samples will be received unless delivery charges are prepaid. A letter should accompany sample, giving locality where mineral was found and the nature of the information desired.

## THE STATE MINING BUREAU

CORDIALLY INVITES YOU TO VISIT
ITS VARIOUS DEPARTMENTS MAINTAINED
FOR THE PURPOSE OF FURTHERING
THE DEVELOPMENT OF THE

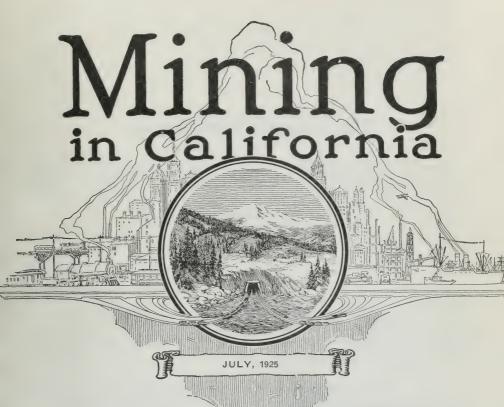
## MINERAL RESOURCES OF CALI-FORNIA

At the service of the public are the scientific reference library and reading room, the general information bureau, the laboratory for the free determination of mineral samples found in the state, and the largest museum of mineral specimens on the Pacific Coast. The time and attention of the State Mineralogist, as well as that of his technical staff, is also at your disposal.

Office hours: 9 a.m. to 5 p.m. daily. Saturday, 9 a.m. to 12 m.

> LLOYD L. ROOT, State Mineralogist.

Third floor, Ferry Building, San Francisco, Cal. Branch Offices: Pacific Finance Building, Los Angeles; Chamber of Commerce Building, Sacramento, Bakersfield, Taft, Coalinga Santa Maria and Santa Paula.



PUBLISHED QUARTERLY

CALIFORNIA STATE MINING BUREAU

> FERRY BUILDING SAN FRANCISCO

## CALIFORNIA STATE MINING BUREAU.

#### EXECUTIVE AND TECHNICAL STAFF

LLOYD L. ROOT State Mineralogist

WALTER W. BRADLEY
Deputy State Mineralogist

#### MINING DIVISION

C. A. LOGAN, District Mining Engineer	-	-	-	-	Sacramento
C. McK. Laizure, District Mining Engineer -	-	. <b>.</b> .	-	-	San Francisco
W. BURLING TUCKER, District Mining Engineer	-	-	-	-	Los Angeles
FRANK SANBORN, Mineral Technologist	-		-	-	San Francisco
W. F. Dietrich, Ceramic Engineer	-	-	-	-	San Francisco

#### DEPARTMENT OF PETROLEUM AND GAS

R. D. Bush, State Oil and Gas Supervisor - - - - San Francisco

Note.—A detailed report of the activities of the Department of Petroleum and Gas is issued monthly by the State Mining Bureau, entitled 'Summary of Operations, California Oil Fields.'

## CALIFORNIA STATE MINING BUREAU

FERRY BUILDING, SAN FRANCISCO

LLOYD L. ROOT

State Mineralogist

Vol. 21

JULY, 1925

No. 3

## CHAPTER OF

# REPORT XXI OF THE STATE MINERALOGIST

COVERING

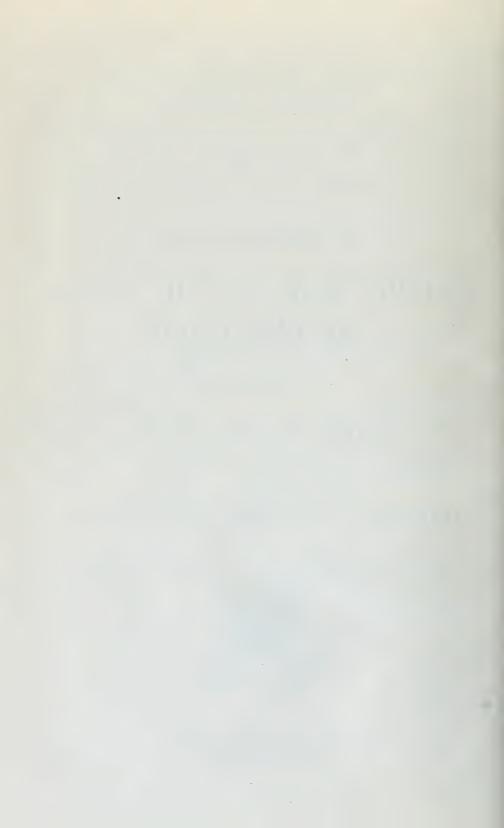
## MINING IN CALIFORNIA

AND THE

## ACTIVITIES OF THE STATE MINING BUREAU



CALIFORNIA STATE PRINTING OFFICE JOHN E. KING, State Printer SACRAMENTO, 1925



## CONTENTS.

	Page
DISTRICT REPORTS OF MINING ENGINEERS	275
Sacramento Field Division	275
San Francisco Field Division	281
Los Angeles Field Division	
Oil Field Development Operations	383
SPECIAL ARTICLES	390
Ore and Bullion Buyers' Licenses	390
ADMINISTRATION DIVISION	397
DIVISION OF MINERALS AND STATISTICS	398
Statistics	398
Museum	402
Laboratory	403
LIBRARY	404
PRODUCERS AND CONSUMERS	410
EMPLOYMENT SERVICE	411
BUREAU PUBLICATIONS	I







#### PREFACE.

The State Mining Bureau is maintained for the purpose of assisting in all possible ways in the development of California's mineral resources.

As one means of offering tangible service to the mining public, the State Mineralogist for many years has issued an annual or a biennial report reviewing in detail the mines and mineral deposits of the various counties.

The weak point in work of this character has been that the results of field investigations were so long in preparation that they had lost much of their usefulness by the time they finally appeared in print.

As a progressive step in advancing the interests of the mineral industry, publication of the Annual Report of the State Mineralogist in the form of monthly chapters was begun in January, 1922, and continued until March, 1923.

Owing to a lack of funds for printing, quarterly publication was

begun in September, 1923.

For the same reason, beginning with the January, 1924, issue, it has been necessary to charge a subscription price of \$1 per calendar year, payable in advance; single copies, 25 cents apiece. 'Mining in California' will continue to be sent without charge to our exchange list, including schools and public libraries, as are also other publications of the State Mining Bureau.

Pages are numbered consecutively throughout the year and an index to the complete reports is included annually in the closing number.

Such a publication admits of several improvements over the old method of procedure. Each issue contains a report of the current development and mining activities of the state, prepared by the district mining engineers. Special articles dealing with various phases of mining and allied subjects by members of the staff and other contributors are included. Mineral production reports formerly issued only as an annual statistical bulletin are published herein as soon as returns from producers are compiled. The executive activities, and those of the laboratory, museum, library, employment service and other reatures with which the public has had too little acquaintance also are reported.

While current activities of all descriptions will be covered in these chapters, the Bureau will not discontinue its practice of issuing from time to time technical reports on special subjects. A list of such reports now available is appended hereto, and the names of new bulle-

tins will be added in the future as they are completed.

The chapters will be subject to revision, correction and improvement. Constructive suggestions from the mining public will be gladly received, and are invited.

The one aim of the Mining Bureau is to increase its usefulness and to stimulate the intelligent development of the wonderful, latent resources of the State of California.



#### DISTRICT REPORTS OF MINING ENGINEERS.

In 1919–1920 the Mining Department was organized into four main geographical divisions, with the field work delegated to a mining engineer in each district working out from field offices that were established in Redding, Auburn, San Francisco and Los Angeles, respectively.

This move brought the Bureau into closer personal contact with operators, and it has many advantages over former methods of con-

ducting field work.

To continue this system most effectively with the limited funds available for the present biennium, the Redding and Auburn field offices were

consolidated and moved to Sacramento on June 1, 1923.

The boundaries of each district were adjusted and the counties now included in each of the three divisions, and the locations of the branch offices, are shown on the accompanying outline map of the state. (Frontispiece.)

Reports of mining activities and development in each division, prepared by the district engineer, will continue to appear under the proper

field division heading.

Although the petroleum industry is but little affiliated with other branches of mining, oil and gas are among the most valuable mineral products of California, and a report by the State Oil and Gas Supervisor on the current development and general conditions in the state's oil fields is included under this heading.

## New County Reports.

The series of separate reports on the mines and mineral resources of the different counties, that together comprise the State Mineralogist's Reports XIV to XVII, inclusive, in the case of many of the counties have become exhausted. Those still in stock are in need of revision. It has been thought advisable, therefore, beginning with the January, 1925, issue of 'Mining in California,' to make the district engineers' reports in the form of a complete general report on the mines and mineral resources in one or more of the counties in each district.

This program will be followed as near as possible in succeeding numbers of the quarterly until each county in the state has been covered.

#### SACRAMENTO FIELD DIVISION.

C. A. LOGAN, Mining Engineer.

Ancient Channels of the Duncan Canyon Region, Placer County.

The accompanying map is the first one ever prepared showing in detail the claim boundaries, topography, location of placer mining workings, and approximate location of buried ancient channels in the region of Duncan Canyon, Placer County. The area mapped extends from Duncan Peak (elevation 7177 feet) southwest to near the mouth of Duncan Canyon, which empties into the Middle Fork of American River just south of the map, and is in the eastern part of the county being accessible during the dry season by automobile from Colfax and Auburn via Forest Hill. The various claims are from 54 to 58

miles from Auburn. They lie at elevations of from 4200 to 5000 feet, and are isolated in winter because of heavy snowfall. The old placer mining camp of Last Chance lies a few miles west, and mail and light supplies come in that way by pack trail from Michigan Bluff.

## Topography and Geology.

The area mapped is a well timbered mountain ridge sloping gently southwest but pitching off abruptly into Duncan Canyon on the east. This ridge is for the most part covered by a thick mantle of andesite mud flows with bedrock exposed at Millers Defeat and on the lower slopes of the canyon. The bedrock series here includes the older carboniferous rocks, principally clay slates, quartzite and quartzitic sandstone, chert and hard siliceous schists, locally grouped as the Blue Canyon formation. No gold quartz mines have been worked at depth here, but considerable rich float has been found on the west side of the canyon. At the Barney Kavanaugh diggings in the east half of Sec. 21, T. 15 N., R. 13 E. gold occurs in quartz stringers and seams in the sandstone and clay slate bedrock and has been profitably hydraulicked. Millers Defeat Canyon has also been hydraulicked. On the Duncan Canyon side in early days all the larger canyons and ravines supported many placer miners, principally Greeks, of whom the only remaining records are a few local landmarks and names. It seems probable that these ravines derived their coarse gold from the erosion of older channels and morainal deposits on the west side of Duncan Canyon and that most of the gold came originally from bedrock erosion nearby. Fragments of such older deposits have been hydraulicked at a number of places and enough has been done to prove the existence of a system of channels. These channels show gravel and sub-angular rock derived from the more resistant members of the country bedrock, and carry little quartz. Such a channel as that in the Jack Robison claim corresponds to the intervolcanic system of the lower mountains; the gulch channels, such as in the Glenn Mine, are undoubtedly earlier. No strictly primary channel was noted here, although there is such a channel in the Carmack Mine at Canada Hill, at a higher elevation.

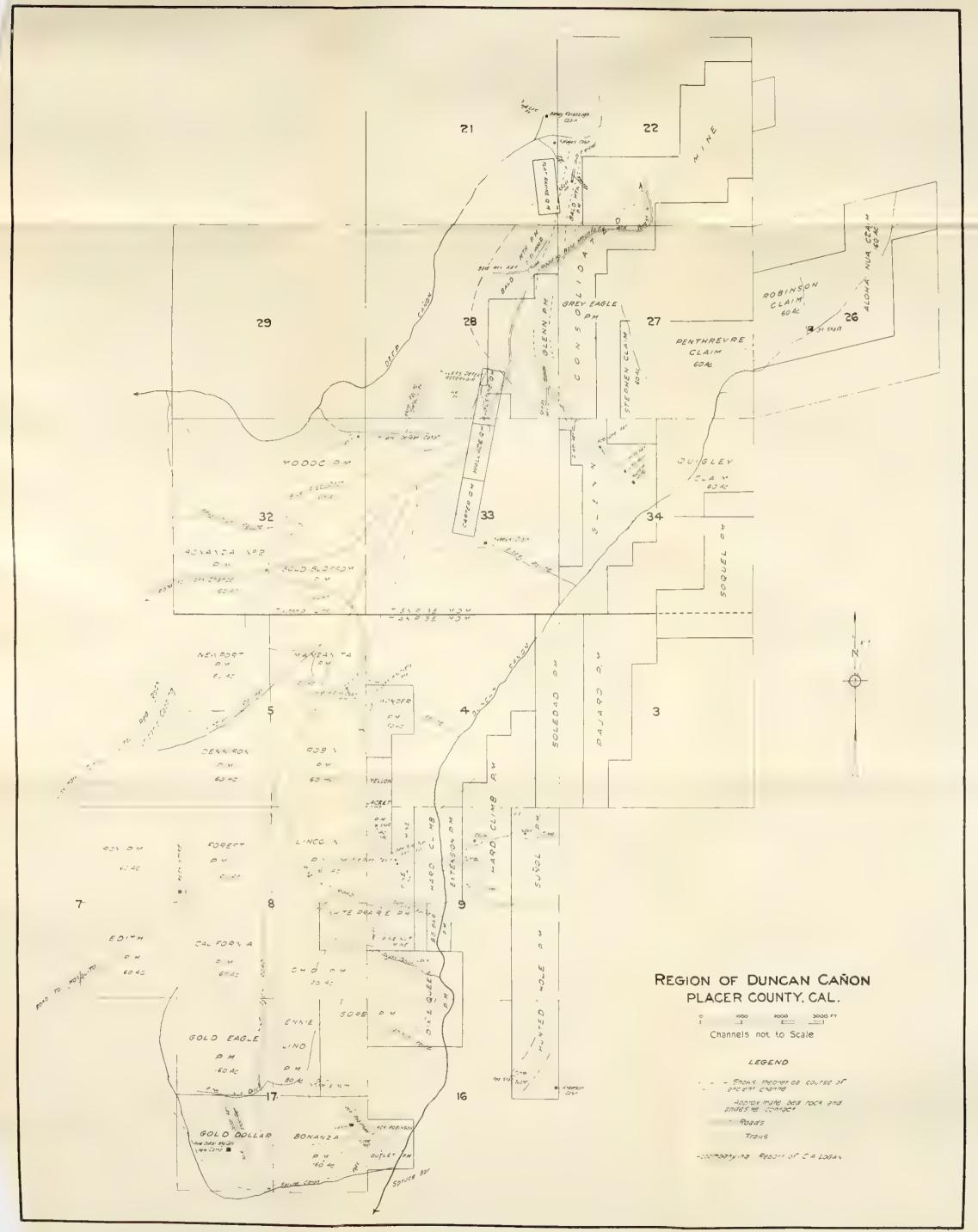
#### Acknowledgment.

The area has not been covered by the public land survey and the writer is indebted to the late E. A. Hill and J. B. Warner and to J. A. Shields, county surveyor, from whose private surveys most of the details of claim boundaries, section lines and bedrock contacts have been compiled.

Gold was mined here first in the '50's, but the area remains a baffling puzzle to the drift miner, with an early day record of very rich surface placers, but with a small production in later years from the deeper ground, and with miles in length of unexplored channels, some of which may be traced to the center of the mountain range.

Mining development is summarized below. The courses of the ancient channels are problematical, except where proven, because of the heavy and widespread andesite cover and scarcity of bedrock rim exposures.

Bald Mountain Mine. F. C. Vinzke, Westville. In Secs. 21, 22, 28, T. 15 N., R. 13 E., 160 acres. The old adit, 800 feet long with a short





incline and 1000 feet of drifting northeast upstream, failed to bottom the channel and followed the west rim. This is in the northeast quarter of Sec. 28. In the southwest quarter of Sec. 22 a shaft 100 feet deep with some drifting along the channel was in pay gravel, but is caved. A new adit was begun 300 feet lower than the 800 foot adit on the Deep Canyon side, but has not been completed to the channel. This channel is the upstream continuation of the Glenn channel. Idle for years.

Blue Eyes Prospect. S. S. Caples and Mrs. Emma Caples, 3634 Sixth Avenue, Sacramento, owners. Gold Dollar Mining Company, lessee, with option to purchase. Comprises Modoc, Bonanza No. 2, Gold Blossom, Newport, Manzanita, Dennison, Robin, Yellow Jacket, Wonder, Roy, Forest, Edith, California, Ohio, Gold Eagle, Jennie Lind, Gold Dollar, Bonanza and Jack Robison placer claims, containing in all about 2580 acres, extending from Deep Canyon to Spruce

Canyon.

The earliest work was done in the '50's by A. Houck. An hydraulic pit was opened on the Wonder claim and another farther south on the Yellow Jacket. These were on a steep channel which flowed south from Millers Defeat and the top portion of which was worked in the intervening modern gulches but has never been bottomed, as far as can be learned. The New Blue Eyes adit was run 500 feet north of west from the southeast corner of Yellow Jacket claim toward the channel but has not yet reached it. On the adjoining Pine Nut Mine this channel shows angular unassorted gulch wash. It has probably been cut off by the later and deeper channel running southwest from the Dixie Queen Mine.

On the southeast quarter of Gold Dollar claim a tunnel was started a few years ago and has been run 2300 feet northwest. Some promising gravel was found in a winze near the portal, but no channel has been bottomed and most of the adit is in the andesite. Attention has lately been turned to the old Jack Robison adit which was started in a good sized channel carrying coarse boulders. This adit was too high at the start and although it has now been run 900 feet it has not yet bottomed the channel. This channel has probably swung around in a wide curve from the Dixie Queen Mine, cutting off all the smaller and richer gulch channels in its path. Possibly of generally low gold content itself, it is no doubt enriched wherever it has cut other channels and may prove worth following in search of these crossings. The elevation at the portal of Jack Robison adit (not on bedrock) is 4550 feet (aneroid), and the portal of the Gold Dollar adit is 50 feet higher. The property is equipped with good camp buildings and has a private road to within one-fourth mile of the camp.

Dixie Queen Mine. J. Scherer, A. Morehead and J. Franks, owners. Contains Gore and Dixie Queen claims, 240 acres. Work has been done on Dixie Queen claim. An adit has been run 800 feet nearly south and an area about 200 feet long and 55 feet wide 15 feet above the adit has been breasted, yielding about \$7,000. The tunnel is now partly caved and little has been done the past few years. A width of 60 feet to 87 feet of gravel has been opened and probably three-fourths mile of channel remains unworked. This channel runs nearly south and is generally supposed to be the same as in the Hard Climb and

Jack Robison. The elevation on bedrock at the Dixie Queen is 4625 (aneroid) which would indicate a very steep grade from the Hard Climb, unless there has been faulting along Duncan Canyon. Water is taken from Abrams Canyon, 25 to 30 inches being available 10 months of the year. There is a dwelling on the claim, which is reached by trail from the Pine Nut Mine.

Glenn Consolidated Mine extends through Secs. 22, 27, 28 and 34, T. 15 N., R. 13 E., as shown. Owner, Glenn Consolidated Mining Company, George McAulay, A. K. Robinson et al., Auburn. Leased to Tillotson Mining Company, F. Tillotson, superintendent. As described in our Preliminary Report No. 8, January, 1922, this mine has been the only producer in the district lately. With the exception that the lowest adit has been extended, and work has been continued in the upper Shields tunnel with a substantial gold production from both, the extracts following from the above report sufficiently describe

the property.

"The lowest and last tunnel is one driven by the present company and starts 600 feet north of the south line of the Outlet claim. It struck pay gravel almost directly below the portal of the Moss tunnel. Up to the time of visit this lower tunnel was 620 feet long and had followed the channel in pay for 150 feet. The gravel had been worked 12 to 15 feet wide. The gravel is mostly hard schist boulders with little quartz in it. It ranges from nothing to  $2\frac{1}{2}$  feet in thickness, being overlain by a coarse volcanic sand which in places closes directly down upon the hard polished schist bedrock. The gold is mostly in the crevices of the bedrock. The thinness or absence of the gravel and the coarseness and location of the gold are due to the steep grade of the old stream. This is plainly shown in the upper

"The upper workings consist of the Quigley tunnel, largely on the west rim, and about 1600 feet long and too high; and the Shields tunnel, which is 1800 feet long including a fork to the right. The portal of the Shields tunnel is 2350 feet north of the portal of the Tillotson tunnel, measured along the channel. The Shields portal is at an elevation of 5345 feet, which is 382 feet above the Tillotson portal. The face of the workings on the left fork of Shields tunnel is 140 feet higher than the portal, showing this steep rise in a distance of 1500 feet, along which there are many sheer drops of several feet, evidently waterfalls in the old channel, and not faults. The Moss crevice, 950 feet in on the Shields tunnel, was 22 feet by 55 feet, and is said to have paid \$9,000. Beginning 735 feet in this tunnel, pay gravel had been breasted for a length of 200 feet and up to 35 feet wide, to the time of visit, July 30, 1921. This breast was said to have yielded about \$10,000 then. The lower workings have since continued in good pay."

The Glenn channel extends on the north into the Bald Mountain property, and has been proven at intervals for a mile and a half.

Hard Climb Prospect. Owners, McCullough Brothers, of Michigan Bar, and Charles Hilton. Reached by trail from the Glenn Mine or Pine Nut Mine. A bedrock adit 213 feet long running N. 35° E. with crosscuts 45 feet west and 60 feet east showed gravel of low grade the entire width. Another adit 155 feet long struck gravel 50 feet from the portal. A third or north tunnel is 210 feet long and

too high. The channel courses S. 37° W., the direction of flow being shown plainly by shingling of the gravel. A shaft 45 feet deep has been sunk on the west rim of the channel at a point 1000 feet north of the north tunnel. The aneroid reading at the portal of the bedrock adit was 4760 feet. According to H. W. McCullough, \$15,000 has been spent in developing the property, and some of the gravel ran as high as \$4 a ton, the richest being higher than that. The channel is about 300 feet wide and carries little quartz.

There is about 2500 feet of ditch but only a small amount of water

available. There is a dwelling on the property.

Park and Brown. (Barney Kavanaugh diggings.) C. D. McKinley, Auburn, and A. Harmeson. This hydraulic mine contains 160 acres in the east half of Sec. 21, T. 15 N., R. 13 E., has been idle except for assessment work for several years. The deposit consists of the upper decomposed portion, 3 feet to 6 feet deep, of a stockwork of quartz, stringers carrying gold in iron stained shale and sandstone. It covers a side hill area 400 feet by 1500 feet and the larger part has been piped off. The water for working was brought from Deep Canyon and the piping season was only about six weeks.

Bibl: State Mineralogist's Report XV, p. 377.

Pine Nut Mine. Owners, F. C. Davidson and Joseph Scherer, address via Michigan Bluff. It contains the Lincoln and White Prairie placer claims, 320 acres. The camp buildings were destroyed

by a forest fire in 1924.

About an acre was hydraulicked 24 years ago. Elevation of bedrock 4930 feet (aneroid). The channel has a total width of 600 feet and a bank 80 feet high. It has a steep grade said to be 6% and can be traced to near Millers Defeat. It courses south and is believed to traverse this property for one-half mile. It is partly rough, subangular wash with some large boulders, and ground washed is said to have averaged 20 cents to 27 cents a yard. A tunnel on the west side of pit was 40 to 50 feet above bedrock. There is a ditch about 2 miles long with a capacity of 1200 miners inches of water from Spruce Canyon, and 1000 feet of pipe. There is a damsite nearby below the mine.

Robinson Prospect contains the Quigley, Stephen, Penthrevre, Robinson and Aloha Nua placer locations, 700 acres in all, in Secs. 26, 27 and 34, T. 15 N., R. 13 E. Owner, A. K. Robinson, Auburn. The claims are on a large channel which enters the mapped area from the northeast, parallel and close to the present course of Duncan Canyon. The only work has been for assessment purposes. A shaft 35 feet deep was sunk on the bank of Duncan Canyon near the French Meadows trail, but did not bottom the channel, which is here lower than the stream. Due to the channel being below the present drainage, the only place it can be reached by a drainage adit is the extreme south end of Quigley claim or possibly on the adjoining part of the Glenn Mine. This channel is locally known as the Chalk Bluff channel and is commonly believed to be the same one that traverses the Hard Climb, Dixie Queen and Jack Robison ground, although it will be seen that there is a distance of about two miles on the map between the proven sections. Aneroid readings in such a canyon are far from reliable, and as has been shown in the case of the Glenn channel, there

are such sudden changes in grade that no sure conclusions can be derived from a comparison of elevations, except in cases of large variations

Red Star Prospect. (Formerly included Hunted Hole, Sunol, Soledad, Pajaro, Soquel and other claims, but more recently only Hunted Hole placer claim.) The owners are D. M. Ray, of Last Chance, and M. Savage.

There are four adits on this prospect, but part are caved. The lowest is 40 feet long, showing gravel with some large granite boulders. The elevation (aneroid) is 4500 feet. About 600 feet east and 280 feet higher, is another adit, where the workings are caved 95 feet in. A third or north adit, at an elevation of 4790 feet (aneroid) forks ten sets from the portal, one branch running north 130 feet, another northeast 145 feet. In the north branch, the bedrock rises on the east and dips west on the west side. In the northeast branch the adit passes through high bedrock but near the face comes into a channel of well washed, fairly clean gravel containing a little quartz. This work was stopped in gravel. The work indicates either two channels at their junction, or a high reef of bedrock in mid-channel. About 100 feet east of and 10 feet higher than this adit, another was driven 100 feet in gravel well above bedrock. These adits are not shown on the map.

The prospecting of the property indicated gravel of a tenor too low grade to pay steadily, although rich in spots. The aneroid readings indicate such wide differences of elevation between these workings and those west of Duncan Canyon, as to show they are on different channels. One of the Red Star channels is probably an ancient course

of the Middle Fork of American River.

## SAN FRANCISCO FIELD DIVISION.

C. McK. LAIZURE, Mining Engineer.

### DEL NORTE COUNTY.

Introduction.

The territory within the present boundaries of Del Norte County was originally (1850–51) a part of Trinity County, which at that time included all the drainage basin of the Klamath River and its tributaries. In 1851 the northern half of this large area was organized as Klamath County. A part of this county was included in Siskiyou when the latter was formed in 1852. Changes were made in Trinity County's boundaries in 1855, which reduced the area of Klamath County, but it still lacked unity. The seat of county government was successively located at Trinidad, Crescent City and Orleans Bar.

This final move resulted in division and the organization of Del Norte County on March 2, 1857, with Crescent City as the county seat. Its area was considerably larger than at present, and the eastern boundary was changed three times in the next 30 years; it being moved

westward to its present position in 1887.

Klamath County continued to exist until 1875, when its dissolution took effect, part being added to Siskiyou and part to Humboldt.

## Geography.

Del Norte County occupies the extreme northwest corner of the state. It contains 1024 square miles and its population is 2759 (1920 census). The county is noted for its excellent stands of timber, particularly its redwood forests, and this covering somewhat softens the outline of its otherwise almost Alpine ruggedness. Over most of it a dense growth of vegetation so covers formations that prospecting is difficult, and in new country trails must be cut before it can be explored.

The county boundaries coincide closely with the natural drainage basin of Smith River, and this stream and its various branches drain most of the area. A few creeks which head in the southern part flow

south and unite with the Klamath River.

The 'Redwood Highway,' extending up the coast through Humboldt County to Crescent City and thence to Grants Pass, Oregon, is being re-routed and reconstructed so that travelers may now pass through the county with ease. However except for a few main roads, there are

only trails penetrating much of the interior.

Del Norte County has no rail connection with the outside. Lumber schooners and light draft vessels dock at Crescent City, and the county is dependent upon these, auto stages, trucks, wagon and pack trains for transportation. The difficulties encountered are well illustrated in the case of a shipment of copper ore from a property in the Low Divide district to the Tacoma smelter. After trucking over a mountain road to Crescent City and a long delay there at the dock, it was finally taken by schooner to San Francisco and then reloaded onto a larger boat for delivery at Tacoma.

¹Coy, Owen C., California County Boundaries, California Historical Survey Commission, Berkeley, 1923.

## Geology.

A low coastal plain, three to five miles in width, extends from the vicinity of Smith River to a point a few miles south of Crescent City. East of and surrounding this area of Quaternary formations and extending from the Oregon line through Del Norte and south into Humboldt is a belt of Franciscan rocks, mainly sandstones and shales. The eastern boundary of this belt crosses Smith River just west of South Fork, and its contact with the succeeding zone of metamorphic and eruptive rocks marks the line between the Coast Range and the Klamath Mountains. This succeeding zone of metamorphics also extends through the county from north to south, widening out toward the north, where its width is about 15 miles. It is composed mainly of serpentine with unaltered masses of peridotite and many inclusions of 'diorite,' more or less altered. This belt is mineralized and most of the deposits of gold, copper, chromite, and platinum are associated with it. Between here and the eastern boundary there is another narrow belt made up largely of Franciscan schist and slate, intruded by deep-seated igneous and volcanic rocks. Serpentine again predominates along the boundary and extends over into western Siskiyou County.

#### Mineral Resources.

It may be argued that Del Norte is not a 'mining county,' yet mining was probably the first established occupation, and Trinidad and Crescent City were at one time important distributing points for miners' supplies. Rich placer diggings were worked in the early days but no record of their output is preserved. Copper mining was active in the sixties.

Lumbering is at present the principal industry. timber resources may be readily and accurately measured, but its mineral resources are less easily gauged. No large 'deep' mines have been developed, but the isolated position and inaccessibility of the county have been a severe handicap to operations requiring heavy machinery and equipment. From a mining standpoint, the county is still largely unprospected and practically undeveloped. To the small operator or man who wishes to combine mining with other means of earning a livelihood, it offers excellent opportunities. Most of the placer mines are held by early settlers and are thus occasionally worked, as conditions warrant. On account of its sparse settlement and lack of aggressive mining methods, compliance with the mining laws in the matter of locating and doing annual labor has been lax. examination of the recorded notices of location shows in many cases that these do not meet the legal requirement that they contain "such a description of the claim by reference to some natural object, or permanent monument, as will identify the claim located." New highways are rapidly opening up this northwest section of the state, which includes Del Norte, western Siskiyou, Trinity, and Humboldt counties. It is being invaded in increasing numbers by mining men, and, unless claim owners, who have for many years been in undisturbed possession, guard their rights by careful observance of the mining laws, disputes and conflicts over possession may arise.

The chief mineral resources of Del Norte County are chromite, copper, gems, gold, iron, the platinum group metals, silver, and miscel-

laneous stone. Arsenopyrite, einnabar, graphite, molybdite, monazite, asbestos, zircon, and a half dozen other minerals are also found here. Of special interest to mineralogists, in addition to a possible commercial value, is the occurrence of troilite¹ near Crescent City. Troilite is a simple sulphide of iron, FeS. Artificially produced, it is used for technical purposes. The natural mineral has been previously identified

only in meteorites.

The last general report on the mines and mineral resources of Del Norte County appeared in Report XIV of the State Mineralogist, 1913–14. The chromite deposits are described in Bulletin No. 76, 'Manganese and Chromium in California,' 1918. Occurrences of the platinum metals are discussed in detail in Bulletin No. 85, 'Platinum and Allied Metals in California,' 1918 (out of print). They are also mentioned in connection with placer gold deposits in Bulletin No.

92, 'Gold Placers of California,' 1923.

The writer spent ten days in the county in June, 1925, in an endeavor to bring data that had appeared in earlier reports up to date, and in gathering notes on new developments. In order that this report will be as complete as possible, some descriptive matter from earlier publications has been included, especially in the case of properties idle at the time of visit. During the decade between the publication of Report XIV and the present report undoubtedly some operations were started and discontinued, of which it is now impossible to obtain authentic information.

The assistance of members of Crescent City and Del Norte County Chambers of Commerce, as well as the courtesy of mine owners and

operators, is gratefully acknowledged.

The total recorded output and value of the mineral production of the county from 1880 to 1924, inclusive, is given in the accompanying table.

¹ Eakle, A. S., Minerals of California: Cal. State Min. Bur., Bull. 91, p. 48, 1923.

## DEL NORTE COUNTY, 1880-1921.

Year	Gold, value		Platinum		Miscel- laneous	Miscellaneous and unapportioned			
			Ounces	Value	stone ¹ , value	Amount	Value	Substance	
1880	\$215,403	\$300						2	
1881	60,000								
1882	80,000								
1883	135,000								
1884	100,000								
1885	39,390	9							
1886	76,189								
1887 1888									
1889	21,800								
1890	900								
1891	5,586								
1892	4,102								
1893	10,352								
1894	8,000								
1895	8,250								
1896	24,150								
1897	16,710								
1898	9,057								
1899	4,450								
1900	3,483								
1901	10,612								
1902	5,450								
1903	7.183								
904	7,399		1.5	\$18					
1905	10,590 5,945		1.5	22					
1906	878	33							
1907	3,488	19				74,787 lbs.	\$9,984	Copper.	
						14,787 lbs. 14,787 lbs.	13,085	Copper.	
1909	1,610	52				24,410 108.	20,000	Unapportioned, 1900-0	
1910	2.388	62				26,670 lbs.	3,395	Copper.	
1911	1.743	7				20,010 105.	0,000	Соррега	
1912	3,940	10							
1913	2,498	16							
1914	2,035	9	14	643	\$3,250				
1915	1,018	6			3,500				
1916	405	2	2	73	1,685	,	267	Chromite and copper.	
1917	1,373	8	10	853	2,700	∫ 3,275 tons	97,255	Chromite.	
	1,010	0	10	000	2.100		2,151	Other minerals.	
1918	565	4	1	97	8,000	7,143 tons	360,485	Chromite. Other minerals.	
	867			, ,			2,584	Other minerals.	
1919	807	6			6,3 <b>00</b> 9,0 <b>00</b>		67 2,781	Chromite and copper.	
920		3	3		5,580		449	Gold, platinum, silver.	
1922	1	3	3		5,500		761	Gold, platinum, silver.	
923	1,778	9	3		31,368		872	Copper and platinum.	
1924	325	0	3		721,720		220	Unapportioned.	
0-1							220	o Lapportiones.	
Totals .	3\$895,002	3\$555	330	\$1,706	\$798,603		\$511,356		

¹Includes crushed rock, rubble, rip-rap, sand, gravel.

²Gold, copper and chromite were produced in Del Norte County earlier than the years shown, but the amounts are not separable by counties.

*See under 'Unapportioned.'

Among the fifty-eight counties of the state Del Norte ranked 26th in the value of its mineral output in 1924.

#### BLACK SAND.

Investigations of the black sand deposits of the Pacific Coast, including those in Del Norte County, have been carried on at intervals by the U. S. Geological Survey,¹ the U. S. Bureau of Mines,² the State Mining Bureau and other agencies and much has been written concerning them. They also have been the subject of hundreds of attempts on the part of individuals and companies to exploit them for their gold and platinum content.

¹ Day, David T., and Richards, R. H., Useful Minerals in the Black Sands of the Pacific Slope, U. S. Geol. Survey, Mineral Resources of the United States, 1905.

² Horner, R. R., Notes on the Black Sand Deposits of Southern Oregon and Northern California, U. S. Bureau of Mines, Technical Paper 196.

The gold-bearing gravels of Smith River basin contain black sand, which usually contains some platinum values and a small annual recovery of platinum metals is common in cleaning up. The beach sands of Del Norte County also carry values in finely comminuted gold and platinum, but although the latter metal has commanded a very high price during and since the World War, no method yet has been developed for working them which has proved commercially successful on anything larger than a hand scale. Probably the simplest type of machine used on beach sands is one described by Haley.¹ It consists of a plain duck broad riffle, fastened to a plank bottom, which is set out near the edge of the sea as the tide is coming in, and is kept constantly in such a postion that the outgoing waves would wash the gold-bearing black sands over it. This machine has been used near Crescent City, and has paid day wages to the men operating it.

The beach two miles south of Crescent City was also the site of one of the most elaborate plants ever erected for working the sands on a large scale. This plant was erected in 1913 by the Oro Del Norte Company, who owned 255 acres along the beach. It was designed to handle 800 yards of sand per 24 hours and cost \$125,000. Metallurgically and financially, however, it proved a total failure, and only a few ruins

still standing upon the beach now mark the location.

The beach near Crescent City has been a favorite place for trying out black-sand machines and processes, but operations are usually short-lived. At the time of visit no beach mining operations were being attempted in the county.

Bibl: State Mineralogist's Report XIV, pp. 375-379; State Min. Bur. Bull. 45, Bull. 85, Bull. 92; U. S. Geol. Survey Bull. 260, Bull. 285, Bull. 315; Min. Res. 1905; Geologic Folios 89, 73; U. S. Bureau of Mines Tech. Paper 196.

#### COAL.

Some thin layers of lignite occur in the underlying formations of the low coastal plain in the vicinity of Crescent City. A vein of tough brown lignite, four feet in thickness, is said to have been pentrated by two bore-holes three quarters of a mile apart and 160 feet deep, located about 400 yards inland, opposite Point St. George. These borings were made in 1885. No further development work has ever been done.

Bibl: State Mineralogist's Reports, XI, p. 198; XII, p. 50; XIII, p. 52; XIV, pp. 373, 380; XVIII, p. 155.

## CHROMITE.

The known chrome ore resources of Del Norte County are extensive, and in addition there is much territory throughout the areas of serpentine and associated rocks traversing the county that holds promise of further discoveries if thoroughly prospected.

In common with practically all of the chrome mines of the state, operations in Del Norte County ceased abruptly with the collapse of the chrome market in 1918, and the mines have since remained idle.

¹ Haley, Chas. S., Gold Placers of California, State Mining Bur. Bull. No. 92, p. 69.

So far as development has shown, the ores here appear to occur typically in lenses, some of which are of large size with well-defined walls. It is the massive black chromite, the chromic oxide content varying from 40% to 50%. This black ore contains very little silica.

The chrome mines and prospects were described in detail in our Bulletin No. 72, 'Manganese and Chromium in California,' 1918, and, as there has been practically no changes since its publication, they will be only briefly mentioned herein.

Copper Creek or Low Divide Mine. Property consists of four claims in Sec. 35, T. 18 N., R. 1 E., in the Low Divide district, owned by the Tyson Estate, Baltimore, Md. A good-sized deposit was opened up here and considerable production was made before the decline in price caused the mine to be shut down.

French Hill Chrome Mine. Property is in Secs. 5 and 6, T. 16 N., R. 2 E., on the north slope of French Hill. A considerable output of high-grade chromite came from this property which is also owned by the Tyson Estate, Baltimore Md. Both the Copper Creek and French Hill mines were under lease to R. D. Adams and C. S. Maltby, Humboldt Bank Building, San Francisco, during their period of activity.

Friday Prospect. Located in the High Plateau district in Secs. 21 and 28, T. 18 N., R. 2 E. A 6-foot outcrop showed on this property which was owned by John Hester and H. H. Morrell, of Crescent City.

Hawkins Deposit. Property lies one mile west of the Friday prospect, in Sec. 21, T. 18 N., R. 2 E. An outcrop of good chromite, with a maximum width of 30 feet, was exposed here. A sample is said to have shown 56% Cr₂O₃. This deposit is probably one of the best in the county, and large expenditures were made in constructing a road to connect it with the Crescent City-Grants Pass road, at a point north of the Oregon line. One hundred sixty men are said to have been engaged at one time on road construction. Special narrow-gauge trucks were constructed to transport the ore. Owned by S. J. Hawkins, of Crescent City.

High Plateau Group. Consists of four claims in the south half of Sec. 30, T. 18 N., R. 2 E. Lenses of ore 10 feet and 8 feet wide were exposed for over 100 feet in length. Owned by H. H. Morrell and John Hester, of Crescent City.

Owl Claim. This property adjoins the French Hill Mine. An ore-body 7 feet in width was exposed on the claims. Owned by Silas White

et al., Crescent City.

Numerous other claims were located during the emergency caused by the World War, particularly in the vicinity of Gordon Mountain ten miles east of French Hill, and in the Rattlesnake Mountains. Between French Hill and Upper Coon Mountain, on the east, and Madrona, on the south, other locations were made during the summer of 1917. These locations are accessible by trail only and are undeveloped.

Bibl: State Mineralogist's Reports, X, p. 167; XII, p. 36; XIII, p. 48; XIV, p. 380. State Min. Bur. Bull. 38, p. 268; Bull. 76, pp. 124–131; Bull. 91, p. 109.

## CLAY.

The local demand for brick and tile is so small that there has been practically no development of a clay industry, although a small brick plant was at one time operated in Elk Valley. Common brick clay is said to be abundant in Elk Valley, and possibly some deposits may be suitable for pottery use. No special investigation of the clay deposits has ever been made, and at the present time this mineral resource is not being utilized.

Bibl: State Mineralogist's Report XIV, p. 379; State Min. Bur. Prel. Report No. 7, p. 46.

#### COPPER.

Copper holds an important place among the mineral resources of Del Norte County, and it is interesting to note that the mines in this county were prominently identified with the beginning of the copper mining industry in California. Copper mining was actve here in the sixties, and thousands of tons of high-grade ore were shipped to

European smelters.

Occurrences of copper minerals are widespread. The ore is often very high grade, consisting of copper glance, black and red oxides, carbonates and native copper. Chalcopyrite is found in minor amount. Gold and silver values almost always accompany the copper. Most of the deposits are found in the serpentine areas or associated with them and are in the form of irregular veins, lenses and bunches. Diorite dikes are common, and where these occur the ore is considered more persistent.

So far as development has shown, the principal districts are Low Divide and Diamond Creek, in the northern part, and the Dr. Rock district, in the southeastern part of the county. Prospects have also been noted in the Monumental district, at French Hill and in other

scattered localities.

Alta California Mine. A detailed description of this property and map of the working is contained in Report XIV of the State Mineralogist. Between the years 1860 and 1870 the mine was operated through an incline shaft 455 feet deep, having an inclination 63° E. A total of 895 feet of drifting had been done on the four levels. ore was shipped to Swansea, Wales, and to Germany. From old records it is shown that ore carrying 15% to 18% copper was mined and 11% ore was being taken out at the time the mine was closed down. Records of shipments sent to Swansea give returns of \$41 to \$102 per ton. The mine has been idle for many years, and all equipment has been removed. Owned by the Alta California Mining Co., 519 California Street, San Francisco. It was bonded for a time to the Salt Lake-California Copper Co., of Salt Lake City, Utah.

Doctor Rock Group. This property includes six claims situated in T. 13 N., R. 3 E., H. M., at the head of Blue Creek. The claims have an elevation of 4475 feet. A 15-mile trail is the only means of reaching them. The ore is quartz, carrying chalcopyrite and other copper sulphides, with gold and silver values. Assays showing 40% copper, \$3 in silver and \$5 in gold are reported. Assessment work is kept up. The mine is offered for sale for \$10,000 by the owner, Martha Thompson, Orick.

Frank Zaar Copper Minc. Property consists of four claims on Copper Hill, owned by Frank Zaar, of Smith River. There is a prominent gossan on the claims, and several veins from four feet to six feet in width, carrying gold-silver values and up to 10% copper, have been cut in doing development and assessment work. There is over 1500 feet of tunnel work and several shafts. Assessment work is being kept up by the owner.

Hunters Luck Claims. This group has been help by location since 1907. There are six claims, located in T. 18 N., R. 3 E., at an elevation of 3100 feet. Malachite, bornite, and chalcopyrite occur in a vein striking north and dipping 50° E. Assessment work and some development are being done by the owners, J. W. Ehrman and J. W. Britten.

Occidental Group. Property consists of four claims in the Low Divide district, lying south of and adjoining the Alta California. Owners are McBride, Musgrove and Carson. Workings consist of a 450-foot tunnel, which has not yet reached the vein, a 110-foot shaft, which shows two feet of ore, and another shaft 100 feet in depth. Surface ore on this property shows a high copper content running from 30% to 32%. Assessment work is being done.

Oriental Copper Claim. One claim, formerly owned by E. R. Jenkins, of Crescent City, but now included in the Frank Zaar Copper Mine holdings. Some high-grade ore was exposed on this claim.

Salt Lake-California Mine. Originally known as the Union Copper Mine, this property, which adjoins the Alta California Mine, was formerly owned by the Salt-Lake-California Copper Co., of Salt Lake City, Utah. The latter company has gone out of existence, and the mine, again renamed the Union Copper Group, is now owned by Frank Zaar, of Smith River. (See Union Copper Group.) Four hundred tons of ore from a 60-foot winze are stated to have averaged 18% copper and \$1.50 per ton in gold.

Sanger Peak Copper. A Chicago company, known as the Claim Holders Association, did some prospecting, including diamond drilling, on a property in the northeastern part of the county a few years ago. Little could be learned regarding the work. The deposit is presumed to be in the vicinity of the Preston Peak Mine, on which considerable work was done by Boston parties previous to 1901, when it was closed down. Preston Peak is in T. 17 N., R. 5 E. This district is the best reached by road and trail from Waldo, Oregon.

Schofield Copper Mine (formerly Klondike Group). There are 10 claims in this property, namely, Goss, Hooligan, Leander, Hard-to-Beat, Ida, Crescent, Klondike No. 1 and No. 2, and Bear Woller. They are situated in the Monumental district, at the head of Patrick Creek, in Sec. 14, T. 18 N., R. 3 E., H. M., the nearest town being Waldo, Oregon. The Grants Pass road passes within one mile. The claims are within the Klamath National Forest, and are well-timbered. Elevation, 1500 feet. Three veins have been exposed, the principal one being of quartz, four to five feet in width, carrying marcasite and chalcopyrite with some gold values. A 300-foot tunnel cuts this vein

at a depth of 150 feet. The deposit has been proved on the surface for 3000 feet. Mining, which amounts to little more than assessment work, is done by hand. The camp buildings are good. Owned by John Schofield, Crescent City, who has held the group since 1910.

Superior Copper Mine. Formerly known as the Atlantic Pacific Copper Mine. It comprised 14 claims, adjoining the Salt Lake-California Mine on the north, and is described in Report XIV of the State Mineralogist. Two claims of this group are now included in the Union Copper Group, owned by Frank Zaar, and the rest have been abandoned. It was a small producer in the past.

Union Copper Group. Owner, Frank Zaar, Smith River, California. The group includes eight claims of the former Salt Lake-California Copper Company's holdings and two claims, formerly a part of the Superior Copper Mine, taking in the principal workings in the Low Divide district. They include the Copper King, Daisy, Bonanza, Union No. 1, No. 2 and No. 3, Mammoth No. 1 and No. 2, Turner, and Gaine, all lying north of and adjoining the Alta California property. The elevation is 1800 feet. They are situated at the head of Copper Creek, a branch of Rowdy Creek, which furnishes a water supply. There is some timber suitable for mining purposes on the claims. The principal copper-bearing lode, which strikes north, passes from the Alta California through the Union No. 1, Union No. 2, Union No. 3, and Mammoth No. 1 claims. On Union No. 1 there is a 450 crosscut adit which cuts the orebody. The vein was drifted on several hundred feet each way and most of the early production was stoped from this working. There is also an upper tunnel, 120 feet in length, on this claim with drifts north and south 40 feet in length. On Union No. 2 there is an open cut, and on Union No. 3 a 100-foot shaft. Mammoth No. 1 claim is developed by a 400-foot crosscut adit, and assessment work is being done mainly in this adit. There is a 4-foot cross vein striking southeast through Bonanza claim and intersecting the main vein on Union No. 3 claim. An adit has been driven 350 feet on this vein, which averages four feet in width, but the ore is not as high grade as that in the north-south vein.

The vicissitudes of mining are vividly brought to mind by a visit to the Low Divide district, now deserted (except for one resident,, Frank Zaar), and it is difficult to avoid 'romancing' when one realizes that over the same road that 5-ton auto trucks transported chrome ore in 1917-1918 "to save democracy," wagon-loads of high-grade copper ore were being hauled out during the Civil War in 1863-64, bound for Swansea and Germany. The once lively copper camp at Altaville, with several hundred inhabitants and some substantial buildings, has completely disappeared. But the mines are still there, and the recent abrupt ending of chrome mining and the cessation of copper mining at an earlier day, have this basis in common; neither operation ceased on account of the mines being worked out. Economic conditions alone have ended mining in the district for the present. Whenever nearby smelters are available, better transportation facilities are obtained, cheaper methods of recovery developed, or the price of copper advances sufficiently, the copper mines will again become active, and, on account of the high average value of the ores, that time may not be far distant.

Perhaps a dozen other copper prospects have been described by name in early bulletins and reports of the State Mining Bureau, but owing to abandonments, consolidations, relocations, etc., their identity has been lost. For the most part these were not developed beyond the prospect stage.

Bibl: State Mineralogist's Reports, X, p. 167; XI, p. 198; XIII, pp. 57–58; XIV, pp. 380–386. State Min. Bur. Bull. 23, pp. 111–116; Bull. 50, pp. 133–140.

#### GEM MATERIALS.

There is occasionally a small production of semi-precious stones and jeweler's materials from Del Norte County. The materials found here consist mainly of agate, chalcedony, garnet, and jasper. Zircons are a constituent of the black sands of the Smith River basin and ocean beach. No particular deposits of gem minerals are known, the material coming from scattered sources.

Bibl: State Min. Bur. Bull. No. 37; Bull. No. 91.

# GOLD (LODE MINES).

The output of gold from Del Norte County comes entirely from placer operations. Most of the ores in the lode mines are base, requiring concentration and shipment. With present transportation facilities they are too low-grade to be profitably worked. There is little development work being done other than that required in doing annual assessment work. The deepest gold mine shaft in the county is only 240 feet in depth.

Black Diamond Gold Quartz Mine. Property located at an altitude of 6500 feet near the eastern boundary of the county in T. 14 N., R. 4 E., H. M. It is described in Report XIV of the State Mineralogist (1913–1914). At that time assessment work was being carried on. Nothing was learned regarding recent activities, and it is probably abandoned.

Hard Luck Mine. This mine consists of six claims on Monkey Creek in the Monumental Mining district. The vein is quartz carrying gold and arsenical sulphides. Two crosscut tunnels and several hundred feet of drifts have been run in doing assessment work. A lot of five tons of ore shipped to the Selby smelter by a former owner is said to have assayed \$10.40 per ton in gold. Owned by Forester and Bregm, of Tacoma, Washington.

Monumental Consolidated Quartz Mine. Owner, Gunn and Davis Estates; W. F. Williamson, attorney, 11th Floor, United Bank and Trust Company Building, San Francisco. Under option to E. A. McPherson, Waldo, Oregon. This property ranks as the most developed gold lode property in the county, but its early history indicates that it was developed as a promotion scheme and that much money was wasted in the construction of mills, stores and in other ways, that should have gone into legitimate development. The mine consists of eight claims, contining 165.28 acres located in T. 18 N., R. 3 E., in the Monumental district. Elevation, 2560 feet. The vein is quartz, carrying specular iron with gold values and some copper. The walls

are diorite and greenstone. Two varieties of ore are found, a hard rock and a softer ore of lower grade. There is a 2-compartment vertical shaft, 240 feet in depth, and an incline shaft to the 100-foot level from the other shaft. Other workings consist of \(^3\) of a mile of drifts, an upraise from the 100-foot level to the surface and a winze from the 100-foot level; also a number of prospect tunnels from 30 to 40 feet long. All mine machinery has been removed and sold, but the concentrating mill is still on the ground. Power for the mill was furnished by water under 150-foot head through a 6-inch pipe acting on two Pelton wheels. The mine machinery was operated by steam power. The mine has been shut down for about 15 years, but parties are at present looking it over with a view to unwatering the shaft and possibly renewing operations.

Ora Anna Quartz Mine. This property, in T. 16 N., R. 1 E., in the Bald Hills district, is described in Report XIV of the State Mineralogist, 1913–14. It has remained idle during recent years.

Sweet Marie Mine. Property consists of six claims, covering 120 acres on the south fork of Smith River, in T. 14 N., R. 1 E., in the Bald Hills district. Elevation 1500 feet. Owners, Silas White and C. L. Moody, of Crescent City, and G. J. Moore, of Eureka. The deposit consists of a quartz vein averaging four feet in width, carrying free gold and sulphides. Developed by three tunnels, 30, 50 and 70 feet in length. Only assessment work is being done.

# GOLD (PLACER MINES).

Small hydraulic and placer workings have been opened up and worked intermittently at many points on Smith River, and its tributary creeks. In addition to the low bars and benches, there are some high gravel deposits at elevations of 2000 feet or more, in the French Hill, Big Flat, and Bald Hill areas.

Dave Savoy Placer Mine. There are 60 acres in this property, which covers a shallow deposit of gravel in the French Hill district in Sec.32, T. 17 N., R. 2 E. A small reservoir is being constructed, and the gravel is ground sluiced when water is available.

Day Hawk Mine. This property includes the former Shelly Creek Saddle Mine and comprises 15 lode and 4 placer claims. Owner, J. W. O'Day, Crescent City, California. The claims are on Shelly Creek. three miles beyond Patrick Creek stage station, on the Grants Pass road. Elevation, 2014 feet. There is good timber on the property and water is obtained from Shelly Creek and from springs. deposit includes a large porphyry dike, approximately 40 feet in width, striking northwest. Water from the springs has been brought to a small reservoir and is used in sluicing decomposed portions of the dike down the hillside and into sluice boxes. Most of the gold obtained from this work is coarse and rough, but some flour gold is saved also by the use of sacks under the riffles. The gold in Shelly Creek itself is fine, and small amounts of platinum are said to accompany it. The owner works alone most of the time. The dike is said to carry about \$9 per ton in gold. The property might develop into a large low-grade milling proposition if this sample does not represent merely surface enrichment.

Dr. Young Hydraulic Mine. Property consists of four claims adjoining J. M. Darnell's mine in the French Hill district, in Sec. 32, T. 17 N., R. 2 E. Idle.

Elkhorn Hydraulic Mine. This property originally consisted of 2560 acres at the mouth of Patrick Creek, in Sec. 16, T. 17 N., R. 3 E. It is idle and has been abandoned for mining purposes, and is now under lease for a hotel site.

French Hill Mine. Property consists of 160 acres, in Secs. 32 and 33, T. 17 N., R. 2 E., in process of being patented. This is the best developed mine in the French Hill district and has been held by the present owner, J. M. Darnell, since 1898. A water supply of 500 inches under 150-foot head has been brought in from Craigh Creek, and hydraulicking has been carried on at two pits, No. 2 giants being used. In the lower pit the gravel has a depth of approximately 25 feet. Some platinum is obtained with the gold. A large acreage still remains unworked.

George Cook Placer Mine. Is situated on the Middle Fork of Smith River, about three miles below Adams Station. Considerable hydraulicking has been done on both sides of the river. The gravel has a depth of about 25 feet and has yielded a fair return in gold and some platinum. Operation has been very irregular.

George Washington Placer Claims. Property is on Monkey Creek adjoining the Monkey Creek Mine, the two comprising about 480 acres. There has been no mining done recently.

Kaus Placer Mine. Owned by Antone Kaus, and situated on Craigh Creek, in Sec. 1, T. 16 N., R. 1 E. The deposit consists of low benches and creek gravels which are worked intermittently by ground sluicing, yielding coarse gold and platinum.

Marshall Mine. Charles Marshall, of Crescent City, care Patrick Creek Station, recently located a placer gravel deposit on Siskiyou Fork of Smith River in T. 17 N., R. 3 E.

Monkey Creek Placer Mine. This property on Monkey Creek, adjoining the George Washington, is idle. It is now owned by Elmer Jenkins and Fred Haight.

Morgan Mine (formerly Aurora Hydraulic Mine). Property consists of the Linden No. 1 and No. 2, Moore Gulch No. 1 and No. 2 placer claims, the Gray Quartz lode claim, and a 160-acre homestead; 260 acres in all. It is located in the French Hill district, in T. 16 N., R. 1 E., at an elevation of 1600 feet. There is a road from Crescent City, the nearest town to the property. There are springs on the property, but the supply of water for mining is limited. The deposit consists of high bench gravel, mostly small and in places partly cemented. The average depth is from three to ten feet, and it is from 300 to 400 feet wide. The gold is heavy, often running from 25¢ up. It is equipped for small scale working. Owner, J. L. Morgan, Crescent City, who works it intermittently.

Morrell Placer. The Morrell property is on French Hill, adjacent to the French Hill and Morgan Mines. It consists of a similar high

bench gravel deposit. Equipped and worked in a small way. Owner, H. H. Morrell.

Myrtle Creek Hydraulic Mine. Property consists of 18 claims along Myrtle Creek in Secs. 3, 4, and 10, T. 16 N., R. 1 E. The Myrtle Creek Placer Mining Co. is now defunct and the property is idle. The pay gravel is covered with a heavy, nearly barren overburden, forming a high bank, and the recovery is said to have been insufficient to pay for handling such a large quantity of material. The black sands carry platinum.

Nels Christianson Mine. Property consists of 174 acres, mostly bench gravel, near the forks of Smith River, some of which is farmed, but hydraulicking of the gravel benches is usually carried on each winter. A little platinum occurs here with the gold.

Oak Flat and East Fork Groups. Property consists of 270 acres on Patrick Creek, covering bench and creek gravels. Owned by F. F. Raymond and Sons, of Patrick Creek. Some heavy nugget gold has been found on the claims, but the ground has never been more than prospected. The new highway being constructed up Smith River will divert travel from the old road which crosses this property at Patrick Creek Station, and with the practical abandonment of this stage stop, and the probable removal of the hotel to a point on the new highway, real mining operations may be initiated. The ground is reported to be under lease to J. W. O'Day, Crescent City, and the Harris Engineering Co., 502 Haas Building, Los Angeles.

Bibl: State Mineralogist's Reports, VIII, p. 163; X, pp. 166–168; XI, pp. 195–199; XII, pp. 100–101; XIII, pp. 126–130; XIV, pp. 386–390; XVIII, p. 295. State Min. Bur. Bull. 85, pp. 55–64; Bull. 92, pp. 69, 83–85.

#### IRON.

Magnetite is one of the major constituents of the black sands of the Smith River basin. It also occurs in the beach sands at Crescent City, and masses of pure magnetite are found in the French Hill district. Hematite also has been noted, but none of these occurrences can be considered as commercial deposits of iron ore.

#### PLATINUM.

Platinum and allied metals of the platinum group are obtained as a by-product of the placer gold mines. Occurrences of the metal are considered herein under the headings, Black Sand and Gold Placer Mines. C. A. Logan has discussed the platinum resources of the county in detail. Other references are given in the bibliography under Black Sand.

## QUICKSILVER.

Quicksilver ore in small quantities has been found in T. 18 N., R. 2 E., H. M. Another ocurrence of considerable size and possible commercial value is located on Diamond Creek in T. 18 N., R. 2 E.

Diamond Creek Cinnabar Co. J. W. Ehrman, I. L. Cole, and John Taggart, of Monumental, located three claims on the Diamond Creek

¹ Logan, C. A., Platinum and Allied Metals in California, State Min. Bur. Bull. 85.

deposit in 1916. The claims are four miles south of the California-Oregon line and 18 miles from Monumental, all but three miles being by road. The ore occurs in quartz between serpentine walls and is found in rich bunches with a general north-south trend. The orebody is said to be eight feet wide and to overage 1%-2% mercury. In 1917 a 3-pipe Johnson-McKay retort was installed with a daily capacity of one ton. A small amount of ore was put through, and a little quicksilver recovered. Shortly after starting, however, the retort was burned out and operations ceased. Nothing is being done at the mine at the present time.

Bibl: State Mineralogist's Reports, XI, p. 198; XIV, p. 390. State Min. Bur. Bull. 27, p. 195; Bull. 78, p. 41. U. S. Geol. Survey Mon. XIII, p. 366; Min. and Sci. Press, Vol. 29, Aug. 15, 1874.

#### STONE INDUSTRY.

There are no permanent commercial crushed rock or sand and gravel plants in Del Norte County.

George Hood, Crescent City, has a small rock crusher and can supply broken rock in limited quantity. The demand is small.

A. D. Kern Construction Co. Address, A. D. Kern, 290 E. Salmon Street, Fulton, Oregon. There is a large output of rock, which is being used on the construction of the government breakwater at Crescent City, about 210,000 tons having been placed here since 1920. Contracts are let as funds for the work are appropriated, and plants and equipment are installed to correspond. The rock being used at present on the Crescent City breakwater is tentatively classified as an altered grano-diorite. The quarry is on a prominent point jutting into the ocean about three-quarters of a mile northwest of Crescent City, known as Preston Island quarry. The broken rock is loaded on cars by derricks and hauled over a 2-mile railroad to the breakwater by a dinky locomotive.

Webber Construction Co., Crescent City. This company has a number of contracts on the new highway being constructed along Smith River from Adams Station north, of which about 11 miles have been completed and surfaced with crushed rock. The company operates several rock crushing and screening plants in connection with their highway work. These are located at advantageous points as regards getting a suitable character of rock and proximity to the job, and the plants and construction camps are moved as the work progresses.

#### HUMBOLDT COUNTY.

By C. McK. LAIZURE, Mining Engineer.

Introduction.

This county, like Del Norte, originally formed a part of Trinity County. When Humboldt County was separately organized in March, 1853, all of its boundaries were fixed approximately in their present position except the north one. This first ran from the mouth of Mad River easterly to a point near the junction of the Trinity River with its south fork. It remained there until 1875, when Klamath County was disorganized and part of its area added to Humboldt. When this addition was made Humboldt County attained very nearly its present form, and its boundary lines, except for a few minor changes, became identical with the present ones.

## Geography.

Humboldt is one of the north coast counties, adjoining and lying just south of Del Norte. It is bounded on the east by Siskiyou and Trinity counties, Mendocino County borders on the south, and the waters of the Pacific define its western limit.

It has a length of 100 miles from north to south; this being about three times its width. The county contains 3634 square miles, and its population is 37,857 (1920 census). For many years it was without rail connection with the rest of the world and dependent upon ocean and highway for transportation facilities. This condition was remedied in 1914, when the Northwestern Pacific Railroad was completed through to Eureka. Situated on Humboldt Bay and with an excellent harbor, Eureka, the county seat, is the largest city and the principal port in the north end of the state.

Much the greater part of Humboldt County is rugged and mountainous, numerous roughly parallel ridges and spurs of the Coast Range traversing it in a general northwesterly direction. There is an abundance of water, the Klamath River, Trinity, Mad, Van Dusen, Eel and South Fork Eel Rivers, Mattole River, and numerous smaller streams flowing through the county for many miles. Their general course is northwest, parallel with the structural axis of the mountain ranges.

Its forests are at once the most striking and probably the most valuable single natural resource, Humboldt County being famous for its wonderful groves of giant redwoods and enormous stands of other timber. Dairying, agriculture, mining, and commercial fishing are also important industries.

#### Geology.

Sedimentary formations extend from the Mendocino County line north along the coast to a point about five miles north of Arcata. They cover a strip about 12 miles wide at the south end. Where the belt crosses the Humboldt Base Line, the formations have a width of 30 miles, gradually running out to a point at the north. In the southern part the rocks consist of massive marine sandstones, with some shale and limestone beds all of Cretaceous age. The northern part is

¹ Coy, Owen C., California County Boundaries, California Historical Survey Commission, Berkeley, Cal.

composed of clay shales and sandstone of Tertiary age, with small areas of Quaternary sands, gravels and clays, notably along the lower reaches of Eel River. The eastern boundary of these sediments runs a little west of north. In contact on the east and covering all the southeastern portion of the county, and extending northwest to Rocky Point above Trinidad, there is a belt of Franciscan sandstone, chert and serpentine, about 12 miles in width. A long, narrow strip of Cretaceous shales, with lenses of sandstone three to four miles wide, borders the Franciscan on the east. It enters the county on the southeast at Humboldt Base Line, trends northwest and passes out at Stone Lagoon, near Orick.

All that portion of the county lying north and east of this belt is composed of Jurassic, Paleozoic and pre-Cambrian metamorphic and intrusive rocks, including limestone, schists, slates, extensive masses of serpentine, diorite and other crystalline rocks. Most of the gold and copper deposits occur in this area.

### Mineral Resources.

The wealth and prosperity of Humboldt County are obviously dependent upon the output and utilization of those natural resources with which it is so bountifully endowed. The most accessible of these assets is timber and it is not surprising that large amounts of capital have been invested in lumbering and its allied industries. Had an equal sum been devoted to the development of its mineral resources, the mining industry would no doubt rank much higher today than it does; how much, no one can say.

The area that was one organized as Klamath County and later dissolved because of natural barriers to communication and travel still remains a little-known and almost uninhabited empire whose virgin resources are just beginning to attract their due share of attention.

Metal and nonmetallic minerals are included in Humboldt County's mineral resources. The county also contains promising oil-producing formations, which compare favorably with any other area in the state

lying outside the known structures of proved fields.

Gold has been the chief metal mined and miscellaneous stone the most important nonmetallic. Both of these have been produced to the value of several million dollars each since 1880, when the compilation of county records by the State Mining Bureau was begun. Much gold was also taken out in the preceding thirty years, of which there is no public record. The county contains known resources of black sands, chromite, coal, copper, clay, gem materials, granite, iron, limestone, manganese, mineral water, natural gas, petroleum, platinum, silver, volcanic ash, miscellaneous stone and sand and gravel. Other minerals found here, at least in limited amounts, are barite, cinnabar, graphite, tale and magnesite. The last general report on the county's mines and minerals was published in State Mineralogist's Report XIV, 1913-14. The copper resources were described in Bulletin No. 50, Copper Resources of California, 1908. Platinum and allied metals are covered in Bulletin No. 85, 1918 (out of print); placer gold deposits in Bulletin No. 92, 1923; and manganese and chrome properties are mentioned in Bulletin No. 76, 1918.

Bulletin No. 89, 'Petroleum Resources of California,' with special reference to unproved areas, contains a detailed discussion of the oil

possibilities. An earlier report is contained in Bulletin No. 69, 'Petroleum Industry of California,' 1914 (out of print). Both these reports are accompanied by maps. The finding of unbroken folds and structure favorable to the accumulation of oil in quantity appears to be the key to commercial production in this county. As the petroleum industry is distinct from other branches of mining, requiring specialized study, no attempt was made to include it herein.

The writer spent ten days during June, 1925, in gathering notes on present mining operations in the county and collecting data regarding new discoveries and developments. Some material published in earlier reports has been included in the case of properties that were idle, in order that this report might be as comprehensive as possible.

The hearty cooperation of members of the Eureka Chapter of the American Association of Engineers is gratefully acknowledged. Some 80 engineers, representing nearly all branches of the profession, most of whom are associated directly or indirectly with the lumber industry, comprise its membership. Their assistance added materially to the ground that could be covered in the short time devoted to field work. The Eureka Chamber of Commerce is to be congratulated in obtaining the voluntary services of this body in making a study of the county's industrial needs that is under way.

In 1924 Humboldt County ranked 34th among the fifty-eight counties of the state in the value of its mineral output. Nine mineral substances, having a value of \$485,478, were produced. The total recorded mineral

output from 1880 to 1924 is given in the following table:

## HUMBOLDT

Year	Gold,	Silver,	Miner	al water	Brick	
	value	value	Gallons	Value	M.	Value
1880	\$153,940	\$80				
1881	75,000	300				
1882	100,000					
1883	80,000					
1884	115,000					
1885	29,730 83,591					
1886	83,591					
1887	111,532 100,000					
1888	143,701	274				
1890	93,612	82				
1891	99,329	19				
1892	87,515	13				
1893	66,354					
1894	41,326	14	20,000	\$7,200		
1895	92,635		24,000	12,000		
1896	65,093		15,000	10,000		
1897	94,992	57	10,000	2,000		
1898	57,512				300	\$2,500
1899	65,059		6,000	1,500	410	3,870
1900	109,444	1136	6,000	2,000	795	7,100
1901	98,487	159	7,825	2,000	1,005	7,810
1902	60,015		10,000	2,500	2,170	17,040
1903	38,509				1,060	10,445
1904	62,061				2,565 800	21,350
1905	45,824 48,295	240			915	7,600 8,690
1907	40.109	214			140	1,400
1908	33,066	325			760	8,585
1909	25,690	94			1,310	9,750
1910	35,289	150			476	4,048
1911	34,966	169			357	2,880
1912	31,271	150			772	6,415
1913	25,611 18,686	132 57			500 607	4,150 6,120
1914 1915	15,947	62	2,000	500	463	5,565
1916	21,279	55	3,000	750	2	3,303
	,					
1917	23,086	95	2		'	
1918	8,028	72	2		2	
1919	16,260	134	2		2	
1920	2,538	19			2	
1921	2,054	37				
	2,001					
1922	1,330	10	2		2	
1923	2,260	12	2		2	
1924	1,269	7	1		2	
Totals	\$2,557,295	\$3,055	2\$103,825	\$40,450	215,405	\$135,318

¹Recalculated to 'commercial' from 'coining value' as originally published. ²See under 'Unapportioned'. ³Includes crushed rock, rubble, rip-rap, sand, gravel.

## COUNTY, 1880-1924.

Miscel- laneous	Natur	ral gas	Miscellaneous and unapportioned				
stone³, value	M. Cu. Ft.	Value	Amount	Value	Substance		
2100 040							
\$199,240 251,586							
233,454							
193,502							
297,276							
160,845							
				\$362	Platinum.		
				140	Platinum.		
			12.5 ozs.	204	Platinum.		
			30.8 ozs.	555	Platinum.		
					~ .		
13,074			1,280 cu. ft.	1,280	Granite.		
29,170	600	\$300	2,450 tons	7,640	Clay.		
36,700	1,000	500	250 tons	20,985 750	Unapportioned, 1900-1909. Clay.		
37,756	300	150	937 tons	937	Clay.		
229,730	300	150	396 tons	400	Clay.		
439,808	300	150	7,750 lbs.	1,201	Copper.		
208,204	300	150	3 ozs.	115	Platinum.		
335,292	2		,	1,320	Copper and natural gas.		
60,260	2		∫ 7 ozs.	296	Platinum.		
			6 ozs.	192,255 351	Brick, clay, granite, natural gas. Platinum.		
27,014	2		) U OZS.	9,312	Brick, clay, mineral water, natural gas, volcanic as		
21,011			370 tons	21,744	Chromite.		
			210 tons	420	Clay.		
51,082	640	85	]	116	Granite.		
			1,520 tons	57,751	Manganese.		
			2 ozs.	140	Platinum.		
25,198	2			2,516 9,271	Brick, mineral water, pumice. Brick and clay.		
20,130				1,148	Mineral water and natural gas.		
			859 tons	18,513	Manganese.		
133,290	2		{	5,436	Brick, clay, granite, mineral water, natural gas, vo		
					canic ash.		
131,688	2		75 tons	190	Pottery clay.		
			ļ	4,628	Brick, mineral water, natural gas, platinum, pumice		
117,308	2		]	6,399	Brick and clay. Mineral water and natural gas.		
117,508	-		4 fine ozs.	153 413	Mineral water and natural gas. Platinum.		
422,519	2		t tille ozs.	9,915	Clay and clay products, mineral water, natural ga		
				0,010	platinum.		
476,449	2			7,753	Brick, clay, mineral water, natural gas, platinum.		
\$4,110,445	23,440				5.7,		
		\$1,485		\$384,494			

#### BARITE.

The occurrence of barite in Humboldt County has not heretofore been of record.

Liscom Hill Deposit. Near the summit of Liscom Hill, eight miles northeast of Arcata and not far from Blue Lake,, a number of veins of white crystalline barite have been noted. The veins run from a few inches to one foot in width, standing nearly vertical. Good size boulders of barite in the vicinity indicate that development work might uncover a deposit of commercial size. The deposit is on patented land.

## BLACK SAND.

In former years the beach and bluffs of northern Humboldt County were successfully worked at Upper and Lower Gold Bluff, Big Lagoon and Little River. The gold was fine and was saved by use of the



Plant of Thompson Brick Co., Eureka, Cal.

Oregon tom, ordinary tom and amalgamating plates. After the tide had receded, pack mules were taken down and the sand packed away in sacks for washing. Many thousands of dollars were taken out in this manner, but for some reason the gold no longer concentrates in paying quantities, and all work of this kind has been abandoned.

The sands and gravels of Klamath River carry a good percentage of black sand, generally having a gold and platinum content. With ordinary hydraulic operations some or all of these values are lost, but where special effort has been made to collect and clean the sand some production of fine gold and platinum has resulted. Outside of such incidental recovery at the hydraulic mines and a few ounces obtained by hand work by individuals, very little has been done with the black sands in recent years.

Bibl: State Mineralogist's Report XIV, p. 391; State Min. Bur. Bull. 45, Bull. 85, Bull. 92; U. S. Geol. Survey Bull. 260, Bull. 285, Bul. 315; Mineral Resources, 1905; Geologie Folios 89, 73; U. S. Bur. of Mines Tech. Paper 196.

California-Oregon Metals Co., address, 1014 Santa Fe Building, 605 Market Street, San Francisco. This company installed one of their machines embodying the McBride process on the beach at Gold Bluff north of Orick during the past year, principally for the purpose of perfecting the machine and process and for experimental research. The black sand at this point was said to carry 40 cents per ton in gold and platinum. The results of the test were reported as showing that a satisfactory percentage of recovery could be made, but the general tenor of the sands was too low to make operations commercially satisfactory.

## BRICK AND TILE.

Several brick and tile plants have been operated in the county in the past; one at Fortuna and three at Eureka, but the market that can be reached is limited. The Fortuna brick yard, the Humboldt Clay Manufacturing Company and others which formerly operated yards in Eureka, are now out of business.

Thompson Brick Co. (formerly Eureka Brick and Tile Co.). J. D. Thompson, president and owner, Myrtle and Harrison streets, Eureka. This property contains 6.18 acres, located on Eureka Slough, 1½ miles from town. There is a wharf at the plant. The clay used is dug on the property. The deepest excavation is 12 feet, but good clay probably extends to a much greater depth in places. A tractor with Fresno scraper is used to dig the clay. It is dumped in a hopper and elevated from there to a pug mill and disintegrator. From the pug mill the material is fed to a Brevan stiff-mud wire-cut machine, which delivers the green brick or tile to boards for stacking and drying. They are allowed to air-dry about two weeks and are then burned in a 30-foot round, down-draft kiln, having a capacity of 75,000 brick. Wood and oil are used for fuel, the oil at the finish of the burn, which takes place at a temperature of 1850°. Steam power is used to operate the machinery. Eight men are employed when running at full capacity, which is 15,000 bricks per day. The market for the product is mainly within the county.

#### CHROMITE.

No chrome ore was produced in Humboldt County previous to 1918, but the war demand at that time resulted in the opening up of a deposit on the property of the Horse Mountain Copper Co. (see also under Copper). Chromite is also a constituent of the black sands of the beach and placer concentrates. It is said to occur massive near Blockburg, and there are small bodies on Hoopa Indian Reservation.

Horse Mountain Copper Co. The chromite here occurs in a series of lenses, which may be continuous, lying near the top of the ridge at an elevation of 4600 feet, and exposed along the axis for a considerable distance. The deposit was mined in 1918 at two points about 9000 feet apart by open cut methods with pick and shovel. Several hundred tons of ore, averaging 40% to 45.5% Cr₂O₃, were shipped before operations ceased on account of the collapse of the chrome market. There is undoubtedly a large tonnage still available on this property.

Bibl: State Min. Bur. Bull. 76, p. 148; Bul. 91, p. 109.

#### CINNABAR.

E. F. Miller, of Orleans, made some locations about 1915 on a vein carrying cinnabar in the Mill Creek district south of Orleans. Only a small amount of development work has been done.

Bibl: State Min. Bur. Bull. 78, p. 46.

#### CLAY.

A detailed report on the clay resources of the state is in preparation by Prof. W. F. Dietrich, of Stanford University. Field work was begun in the southern part of the state. When completed this report will be published as a special bulletin by the State Mining Bureau. At the present time little definite information is available regarding the clay resources of the north coast counties, including Humboldt. Clays, suitable for the manufacture of common brick and tile, are doubtless abundant. Pottery clays are known to exist, at least in limited quantities. These have been utilized commercially only in a small way and for experimental purposes.

Loofbourrow Clay Deposit. On property owned by Dr. T. L. Loofbourrow, First National Bank Building, Eureka, situated four miles south of Eureka and 4 mile east of the highway. There is a deposit here of dark-blue, smooth plastic clay said to average 22 feet in depth over ten acres. The blue clay is overlaid by four to six feet of yellow clay.

The composition of the blue clay is given in the following analysis by Harry A. Duffy, of Eureka:

Loss on ignition	22.30%
SiO ₂	42.80%
Al ₂ O ₃	38.24%
$\mathrm{Fe_2O_3}$	2.60%
Na ₂ O	
CaO	3.34%
K ₂ O	4.41%
MgO	3.01%
Organic substance	3.20%

A bed of high-grade clay is found on the W. A. Preston holdings (see under Iron). Some of this has been used by R. H. Jenkins, of the Humboldt State Teachers College at Arcata, in the production of pottery and for experimental purposes. Mr. Jenkins has worked with a number of Humboldt County clays.

Weatherby Ranch Deposit. There is a deposit of clay of unknown extent on property of the Hanify Lumber Company, four miles south of Elk River, under lease to Clarence Weatherby, Elk River, via Eureka. The strata exposed in a cut on a ridge through the property shows clay underlaid with two feet of fine volcanic ash. Underneath the ash is six feet of yellow clay, then two feet of lignite coal, with clay again below the coal. Some production of volcanic ash has been made, but the coal and clay have not been developed. The Hanify Lumber Company's railroad runs within 4 mile of the deposit.

#### COAL.

Coal has been known to exist in this county since the early sixties. From time to time new localities where it occurs have been reported and placed on record, but no commercial developments have ensued to date. Conditions up to the present have not been such as to encourage exploitation even of the most promising showings. Lignite coal in quality comparable with much of the lignite found throughout the state can no doubt be produced here whenever a definte demand for this fuel appears. The commercial value of the deposits will remain undetermined, however, until considerable exploration work has been done.

A list of the known occurrences is given herewith, with brief notes concerning the character of the deposits.

- (1) Within the city limits of Eureka, near Twelfth and L streets. The strata from the surface down showed:
  - a. Sand, 16 feet.
  - b. Lignite, 18 to 24 inches.
  - c. Clay, 4 feet.
  - d. Lignite, 1 foot.
  - e. Clay, 3 feet.
  - f. Clay with shells, 1 foot. g. Clay, 11 feet and deeper.

A brickyard was established here at one time. The clay was used in making brick and some of the lignite was utilized to help burn them.

The material had to be dried before used, and was of poor quality. (2) On Sec. 29, T. 5 N., R. 3 E. The first patent taken out for coal land in the Humboldt Land District was for 80 acres in Secs. 20 and 29, T. 5 N., R. 3 E., covering this deposit. The vein strikes N. 45° W., and dips about 45° NE., between walls of argillaceous sandstone. An old shaft was sunk about 45 feet following the dip of the vein on the bank of Maple Creek, where the vein crosses the creek. The shaft is caved and filled up but a small pile of coal remains. Pieces were readily ignited and burned to a fine gray powder. An old tunnel across the creek driven on the vein is also caved and the only exposure at present is in the creek bed. Pieces broken from here showed the coal to be a tough brownish-black lignite. The width of the vein is difficult to determine, but apparently there is from three to four feet of coal. Crogan Creek joins Maple Creek a few hundred yards above here and considerable float is found in Crogan gulch indicating the presence of another vein. The composition of the Maple Creek coal is given as follows: 1

Water	11.75%
Volatile carbonaceous matter	46.80%
Fixed carbon (does not coke)	29.60%
Ash	

¹ State Mineralogist's Report VII, p. 187.

Analyses of three samples from the Maple Creek deposits by Mathyas¹ show:

	a ·	b	c
Water	12.25%	14.00%	14.25%
Volatile matter	50.75%	49.80%	53.75%
Fixed carbon	31.00%	32.95%	29.50%
Ash	6.00%	3.25%	2.75%
Coking qualities: None.			

This deposit is within a few miles of a lumber company's railroad, and is one of the best coal showings so far noted in the county.

(3) Lignite has been reported to occur two miles north of Arcata.

There is nothing definite known regarding this locality.

(4) On the Upper Mattole, in Sec. 12, T. 3 S., R. 1 W. Several small beds six to eight inches thick. The strata have a slight dip to the north. No development.

(5) On Eel River, two miles below Alder Point. An 8-inch seam occurs here from which a few sacks are reported to have been taken

and used for blacksmith work.

- (6) On Jacoby Creek, four miles from Humboldt Bay. Thin seams.
- (7) Occurrences reported on Larribee Creek, in Sec. 26, T. 1 S., R. 4 E., also in Secs. 2, 3, 10, 11 and 21, in the same township and range.

(8) On Eel River, opposite Eagle Prairie.

(9) On the Van Dusen, three to four miles above Bridgeville.

(10) On Yager Creek, 1 mile above Hydesville.

(11) Traces have been noted on the South Fork of Eel River, one mile north of Garberville.

(12) On Bear Creek, one mile east of Garberville.

(13) On Panther Gulch, a tributary of East Branch South Fork of Eel River.

(14) On Buckmountain Gulch, a tributary of the East Branch of South Fork Eel River, a bed two feet in thickness is reported. It has

been used locally in forges with good results.

(15) In T. 4 S., R. 4 E., six or seven miles south of Garberville, on the East Branch of South Fork of Eel River. The coal bed here is said to be three to four feet thick. It dips 50° W. An analysis 2 shows its composition to be:

Water	10.75%
Volatile carbonaceous matter	48.50%
Fixed carbon (firm coke)	38.30%
Ash	2.45%

Ash is a light yellow powder. This coal cokes well.

It has a good luster and is apparently free from pyrites. This may be the same bed noted under (14). Some work has been done here in the past.

(16) Lignite has been found on the Hoopa Indian Reservation.

(17) Coal was uncovered recently in a cut made for a culvert in the highway near Miranda, on the property of W. E. Sinclair of Miranda. It was covered up during construction work without further investigation.

(18) A 2-foot vein of lignite occurs with elay and volcanic ash on the Weatherby Ranch, four miles south of Elk River. Not developed.

¹ State Mineralogist's Report XII, p. 64. ² State Mineralogist's Report VII, p. 188.

At least two or three of the localities mentioned have showings that are worthy of further investigation by anyone interested in the utilization of lignite coal; a matter which is receiving increased attention throughout the country.

#### COPPER.

For many years Humboldt County has held promise of becoming one of the copper producing counties of the state. The belt of Paleozoic metamorphic rocks in which the copper deposits in Del Norte County occur extends north into Oregon and southeasterly through Humboldt and western Trinity counties. Throughout this belt there are scattered deposits of copper ores. Considerable development work has been done in Humboldt County on some of these, but the output of copper has been small. Lack of cheap transportation for shipping ores and inability of the owners of deposits to provide adequate concentration or reduction plants has kept the copper mining industry practically at a standstill. The principal copper prospects and mines are in Red Cap Creek district, Mattole district and at Horse Mountain.

Red Cap Mine. This property is in Sec. 29, T. 10 N., R. 6 E., on the high ridge betwen Red Cap and Boise creeks. Rich float, consisting of native copper and bornite, was found here. In 1880 considerable money was spent in prospecting without locating a definite vein; the ore apparently occurring in bunches and as pockets in the serpentine.

The La Perin group consisted of ten claims adjoining the Red Cap Mine. There has been no activity at either of these properties for years. In the Mattole district two properties are of record at which some work was done in early days. These were the Rainbow group in Secs. 19, 30, and 32, T. 1 S., R. 1 E., and Secs. 12 and 19, T. 1 S., R. 1 W., and the Crimson group in Sec. 8, T. 2., R. 1 E. Nothing has been done at these properties for years.

Vance Property. A ledge said to be eight feet wide, striking northwest and dipping 70° southeast, has been exposed in Sec. 24, T. 3 S., R. 3 E., on property owned by Harry Vance, of Eureka. The ledge carries pyrite, which may be auriferous, and traces of copper. No work has been done on it, and its extent is unknown.

### Horse Mountain District.

Subsequent to the activities in the Red Cap and Mattole districts, copper was discovered on Horse Mountain in the Hoopa Range, which forms the divide between Wood Creek and Trinity River. The most promising and important deposits in the county have since been developed on Horse Mountain. Four properties are described in Report XIV of the State Mineralogist (1913–14). These are the Horse Mountain Copper Mine, the Humboldt Copper Mine, Sweet Home Copper Mine, and Ruby Copper Mine. All of these properties have been absorbed by the Horse Mountain Copper Company, which now controls a large area covering the principal deposits.

The Horse Mountain Copper Mine was recently examined by Mr. James B. Knight, of El Paso, Texas, who kindly placed his data and maps at the disposal of the writer, as well as donating a number of excellent specimens of native copper and high-grade ores to the Mining

Bureau museum. The writer is indebted to Mr. Knight for much of the material embodied in this report on the property.

Horse Mountain Copper Mine. This property is owned by the Horse Mountain Copper Company, a California corporation, organized in 1914. B. C. Schnoor, president; Maud E. Moore, secretary; David Wilson, general manager. Home office, 1118 Fourth Street, Eureka, California. The holdings consist of 120 acres of patented land and 100 mining claims having an area of approximately 2000 acres, held by location. The property is in the Trinity National Forest, in T. 6 N., R. 4 E., about 22 miles by airline east of Arcata. By road it is 26 miles from the mine to Korbel from which point there is rail connection to tidewater. All of this road is state highway except 51 miles between the highway and the mine, which contains grades running from 7% to 11%. The elevation at the mine varies from 5000 feet at the camp to 3350, the lowest point on the property. The winters are mild, but snow occasionally falls on the summit, though not in amount apt to interfere with mining operations. Pine, fir, cedar, and oak are widely distributed over the property; the 120 acres of patented land alone being estimated to contain 412 million feet of saw timber. An abundance of water for domestic and mill use is obtained from springs so situated that pumping is not required. Tunnel No. 6 provides drainage for all excess mine water and this could be used for mill operations if required.

The strike of the ore-bearing formations is northwest with dip to the northeast. The formation is largely serpentine, associated with gabbro, and felsitic and diorite dikes. Much schist has been developed through metamorphic action, schist and diorite forming the principal gangue in the ores. High-grade sulphides and carbonates are widely distributed. Chalcopyrite occurs mainly in the diorite. Chalcocite is common in both the schist and harder diorite. Bornite is found mainly in the schist, with much malachite in the upper workings. Cuprite and chrysocolla are not as common as the other copper minerals. Native copper is widely distributed in the gabbro. The ores average about 30% silicon, 15% lime, and 12% iron. It is estimated that about 12% of the ore produced in quantity will be high-grade (10 to 50% copper), and that 10% of the whole can be sorted to a product carrying 15% copper with the remainder as milling ore averaging 3 to 5% copper. Occasional assays have shown a small gold content, but gold

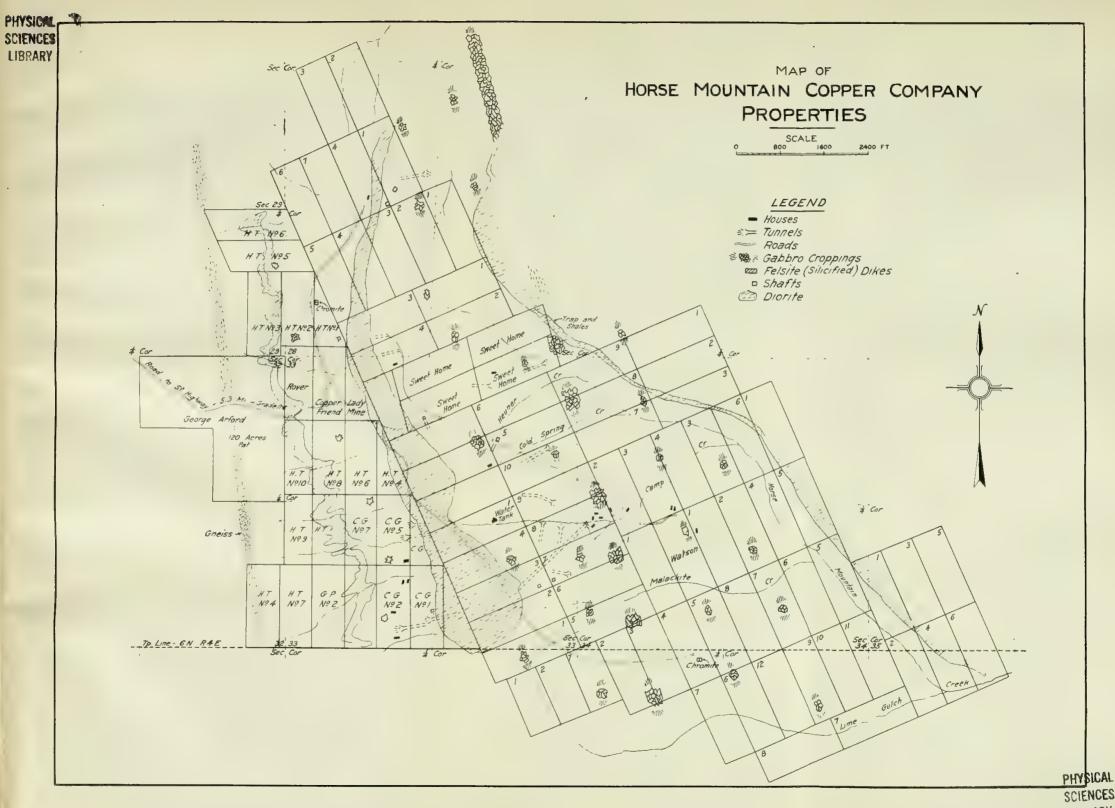
probably does not occur in paying quantities.

Chromite occurs on the property in the serpentine areas. There was some production in 1918 (see under Chromite).

The Western States Gas and Electric Company's power lines pass

within seven miles of the mine.

The total tunnel and drift development on the property is 4675 feet, as shown by the following tabulation prepared by James B. Knight.



SCIENCES LIBRARY



#### DEVELOPMENT CHART.

Elevation B. M. 5300 feet.

Tunnel No.	Eleva- tion, feet*	Cross- cut, feet	Drift, feet	Cut ore	Length, feet	Remarks
1	500	180	120	Entrance. 4' ore at 90' 15' ore at 140'	300	Carbonates, bornite, chalcocite. Assay, 5 and 10 per cent. Shipped ore.
2	270	150		Entrance.	150	Chalcocite and native copper
$\frac{2}{3}$	600	190				
4	500	700	80 on ore	20' at 250' 30' at 340' Ore in face.	80 700	Ore shipped to Tacoma Smelter. Bornite, carbon- ates, chalcocite.
5	100	90		Ore in face.	90	Native and chalcocite.
6	940	1,740		L.E. at 150' Ore at 500' 15' at 900'	30	Bornite, chalcocite. Native Cut diorite at 1,600' show- ing chalcopyrite. Low
				3' at 1.600	1.740	drain.
7	400	90		Entrance and	90	Native; chalcocite. Shipped ore.
8	500	Caved-	no examin	ation-good grade	ore on du	mp.
S.H. 1	1,100	Begun a	s lower dr	ain.	150	Shut down (war).
S.H. 2	750	100			100	Did not reach ore chute.
9A	530	40	60	All in ore.	100	Carbonates, bornite, chalco- pyrite, chalcocite. Shipped ore.
9B	570	180	100	50' ore at 90'. 100' drift at 115' on ore.	280	Shipped ore. Good grades.
'Ruby'	700	700		11' ore at 150' 30' ore at 500'	700	Native and chalcocite. Native and chalcopyrite.
Shaft(ver.)	400			On ore		Native and charcopyrite.  Native: chalcocite: oxides.
Drift	550		25	On ore body	60' wide	Same class as shaft.

# "Humboldt Group"-West Side Axis, Diorite Contacts.

Elevation B. M. 5300 feet.

Tunnel No.	Eleva- tion, feet*	Cross- cut, feet	Drift, feet	Cut ore	Length	Remarks
1 2 3	500 550 550	750 75 50	In diorite	At 500' air-shaft copyrite and al 50' of ore All in ore		rface. Ore at 75'. At face chal- ifferent points. Chalcopyrite, gold values. Chalcopyrite, gold values.

#### 'CHROMITE.'

From two openings (9000 feet apart) \$13,000 of chrome, 40 to 45.75 per cent, was shipped at a profit in 1918. Elevation—425 feet; 700 feet. Total tunnel and drift development, 4675 feet. In addition to tunnel and drift work, there are at least 50 open-cuts and ground-sluices that have exposed ore bodies of from 3 to 100 feet in width of good milling ore, carrying much high-grade shipping

*All elevations read minus (-) B.M. 5300' above sea.

The location and elevation of the various workings are shown on the longitudinal sectional views. On account of the large size of the orebodies, it is believed that much of the ore could be most economically mined by steam shovel. The Horse Mountain Mine is equipped with a small slime concentrating mill for low grade ores. This was only operated a short time before the mine was shut down at the beginning

of the war. The mill test showed the concentrates to contain 20% copper and the middlings about 0.4%. The mill was run by steam power, the equipment including two 50-h.p. boilers; one 14-h.p., one 20-h.p., and one 40-h.p. engine, and a gas engine for furnishing power for mine ventilation. There is also a saw mill and planer, assay office, and bunkhouses and cabins, capable of accommodating 200 employees. When last operated, 26 men were employed underground and on top.

## GEM MATERIALS.

Among the beach stones common at Big Lagoon and other localities are garnet, agate, chrysoprase, jasper, carnelian, etc. The commercial output of these is so small and irregular as to be negligible.

# GOLD (LODE MINES).

Bonneyville Quartz Mine. The Bonneyville Mining Company, former owners of this group of six claims, is evidently out of existence, and there has been no recent work done on the property. The claims are in Sec. 15, T. 6 N., R. 4 E., near the head of Willow Creek, a tributary of Trinity River.

Golden Eagle. Owner, Frank Schweichler, Orleans, California. This prospect was discovered in 1915. It is in the Red Cap mining district at an elevation of about 1000 feet, with abundant timber and water. The ledge is said to be sixteen feet wide, free milling, and to carry gold, silver and copper.

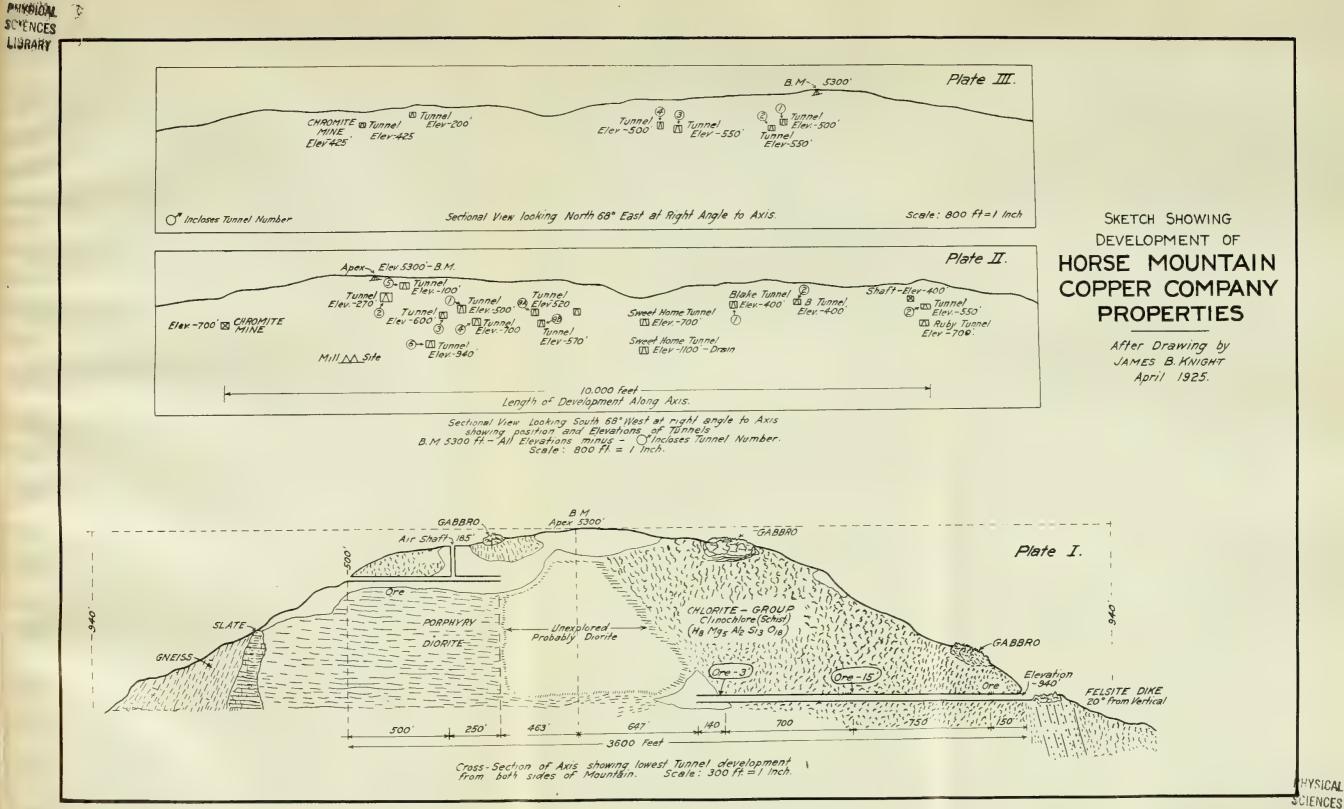
Little Klondike Mine. Property consists of three placer and four quartz claims adjoining the Red Cap Mine at the head of Red Cap Creek. The quartz vein frequently carries good values in gold. Owner, F. Lubbs, of Orleans. It is worked intermittently.

Pearch Creek Prospect. Consists of one claim on a free-milling quartz vein, 6 to 14 inches in width. It is situated three miles from Orleans on Pearch Creek. The rock is milled in an arrastra, run by water power. Geo. Wilder and Anton Lyons, of Orleans, owners.

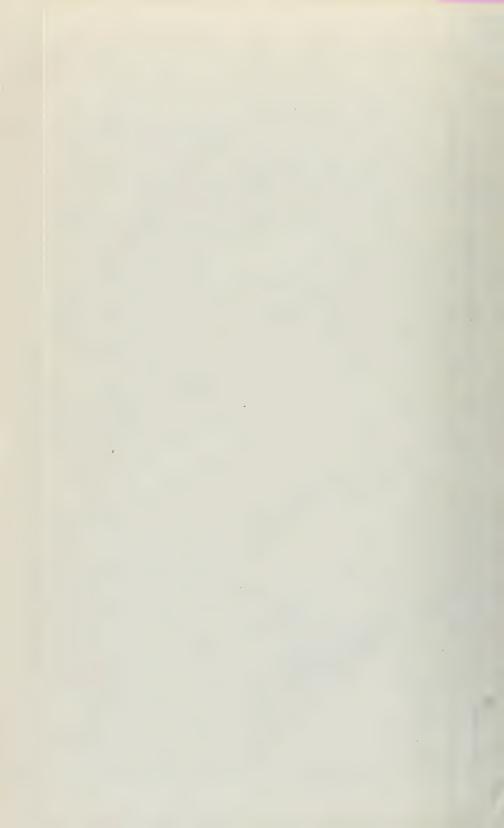
Red Cap Mine. Owned by Red Cap Quartz and Placer Mining Co., J. D. Fleming, president; A. E. Cartwright, secretary, Scotia, California. Ten quartz and three placer claims were formerly included in this group but all have been abandoned except the original three quartz claims. The mine is in Sec. 33, T. 10 N., R. 6 E., on the north fork of Red Cap Creek at an elevation of 2640 feet. The country rock is porphyry and diorite. Four veins, striking northeast and dipping 70° northwest were developed. The ore in the upper levels was free-milling but in the lower levels it is a heavy sulphide, carrying some copper. Recent work has been confined to the lower tunnel which has been driven 550 feet in doing assessment work.

# GOLD (PLACER MINES).

Big Bar and Big Bar Annex. Property comprises five claims covering a bench gravel deposit, located in Secs. 17 and 20, T. 10 N., R. 5 E. It was operated by former owners until 1895, when the flumes were wiped out by landslides. It is now owned by Carl Langford, of Somes



SCIENCES LIBRARY



Bar. Assessment work only is being done. At the present time a drift is being run on the Big Bar Annex.

Bondo Mine (formerly Croton Bar and Markeson Mine). This property, which originally contained 40 acres, is located in Sec. 29, T. 11 N., R. 6 E., on the Klamath River,  $1\frac{1}{2}$  miles above Orleans. The old ditch and flume are out of commission, and in recent years the mine has only been operated on a very small scale. It has lately passed into the hands of W. R. Morres, 421 W. Adams Street, Los Angeles. W. R. Morres et al. have located the following additional claims:  $E\frac{1}{2}$   $E\frac{1}{2}$  of NE $\frac{1}{4}$ , Sec. 30; W $\frac{1}{2}$  W $\frac{1}{2}$  of NW $\frac{1}{4}$ , Sec. 29; W $\frac{1}{2}$  W $\frac{1}{2}$  of SW $\frac{1}{4}$ , Sec. 20;  $E\frac{1}{2}$   $E\frac{1}{2}$  of SE $\frac{1}{4}$ , Sec. 19; T. 11 N., R. 6 E., and the property now extends to Wilson Creek. Early work on the Bondo paid well, and it is expected that this mine will be rejuvenated.

Bibl: State Mineralogist's Report XIV, p. 401.

Cañon Bar Mine. Owner, Willie Norton, Sr., Hoopa Valley. Nearest town, Weitchpec. This property is on the Indian reservation. It was discovered about 45 years ago, and was hydraulicked off and on up to the last ten years. The property contains 40 acres, of which about one acre has been worked off. The pay gravel has an average depth of four feet.

Cavanaugh Mine. On the Klamath River, three miles above Weitchpec, in Sec. 1, T. 9 N., R. 4 E. Originally located in 1870. Worked in later years only in the winter. Idle at present. C. A. Sample, owner, Fresno.

Bibl: State Mineralogist's Report XIV, p. 402.

Clover Flat Placer Mine. This mine, formerly owned and operated by the Clover Flat Gold Mining Co., consisted of 340 acres in Secs. 17 and 20, T. 7 N., R. 5 E., on the Trinity River, one mile north of Willow Creek. It has been shut down for a decade and the property has now passed into the control of I. M. Jameson, 481 W. Highland Avenue, Sierra Madre, California. It is idle.

Bibl: State Mineralogist's Report XIV, p. 402.

Delaney Group. Property consists of three claims, comprising 60 acres, in Sec. 26, T. 11 N., R. 5 E., covering a deposit of free gravel on Camp Creek, which runs through the claims. There is practically no overburden. The ground is virgin and is said to prospect well. Owner, E. J. Delaney, Orleans.

Elkhorn Mine. Owner, G. F. Willhite, Orleans, California. Property consists of 200 acres, containing bench gravels. The mine is located in the Orleans district at an elevation of 500 feet and is reached by trail having a 6% grade. The county is reconstructing this into a wagon road. Trinidad, the nearest railroad point, is 85 miles southwest. The deposit was discovered in 1915. Red Cap Creek furnishes the water supply. The ground is level and covered with timber, the mine being on the forest reserve. It is equipped with a ditch 4000 feet long, supplying water, under 100-foot head, to pipe and giant. Tailings are run into the river. There is a four-room house. Idle.

Bibl: State Mineralogist's Report XVII, p. 506.

Florence Placer Mine. Consists of one claim of 20 acres in Sec. 31, T. 10 N., R. 5 E., on the Klamath River, three miles above Weitchpec. It was last worked during the winter of 1923-24. Wm. Martin, Weitchpec, owner.

Bibl: State Mineralogist's Report XIV, p. 402.

Golden Rod. Property consists of two claims, the Golden Rod No. 1 and No. 2, having an area of 40 acres. It is located in Sec. 26, T. 11 N., R. 5 E., three miles northwest of Orleans. Elevation, 500 feet. Camp Creek runs through the claims which cover creek and bar gravel deposits. The greatest depth exposed is 25′. There are several back channels and bars which are said to prospect good. There is no overburden. The greater part of the deposit is unworked, but Indians and others ground-sluiced a little in early days. Owners, John A. Hunter and C. S. Little, Orleans.

Klamath River Mine. Property consists of 280 acres in Sec. 1, T. 9 N., R. 4 E., and Sec. 6, T. 9 N., R. 5 E. The claims were first located in 1860. It is owned by the J. W. Proffitt and S. M. Briscoe Estate. Operated by the Klamath River Mining Co. There are two miles of flume which carries 1500 inches of water. An 18-inch pipe serves a No. 4 giant and a 16-inch pipe a No. 3 giant, under 200-foot head. The deposit consists of uncemented medium gravel on schist bedrock. The mine was shut down in June, 1925, on account of lack of water. J. E. Moore, 1033 Fulton Street, Fresno, California, has recently taken it under lease.

Bibl: State Mineralogist's Report XIV, p. 403.

Orcult Hydraulic Mine. This property is in Sec. 29, T. 11 N., R. 6 E. It consists of one claim covering bench gravels, two miles northeast of Orleans. There is a ditch three miles long which brings in 500 inches of water under 150-foot head. Owned by Ira Orcult, who works it each winter.

Bibl: State Mineralogist's Report XIV, p. 403.

Orleans Bar. This property consists of 1300 acres of patented land and 600 acres of unpatented land, in Sec. 1, T. 10 N., R. 5 E.; Secs. 25 and 36, T. 11 N., R. 5 E.; Sec. 30 and 31, T. 11 N., R. 6 E., on the Klamath River at the town of Orleans. It was last worked in 1913, by the California Mining and Dredging Syndicate, of which Thomas M. Logan was president, H. DeC. Richards, vice president and general manager, and D. F. Hamon, secretary. There is a large area of ground here on both sides of the river, consisting of both high and low bars. Only a small part was worked off before operations ceased.

Bibl: State Mineralogist's Report XIV, pp. 403, 404.

Peacock Mining Co. Frank Knowland, president; Frank M. Wilson, secretary. Home office, Bank of Italy Building, Oakland. John Andrews, mine superintendent, Orleans, California. The company was organized in December, 1922, and acquired the Jonas Salstrom hydraulic mine, consisting of five claims in Sec. 1, T. 10 N., R. 5 E., and Sec. 36, T. 11 N., R. 5 E., 13 miles southeast of the town of Orleans, together with 95 acres adjoining, known as the Graham patent.



Diversion dam on Camp Creek and flume of Peacock Mining Co., Orleans, Cal. Photo by courtesy of the company.



Hydraulicking at property of Peacock Mining Co., Orleans, Cal. Photo by courtesy of the company.



Bedrock cut and head of sluice, Peacock Mining Co., Cal. Photo by courtesy of the company.



View of sluice showing cast steel-plate riffles, with water off, Peacock Mining Co., Orleans, Cal. Photo by courtesy of the company.



Gravel bank, Peacock Mining Co., Orleans, Cal. Photo by courtesy of company.

The deposit consists of gravel benches on the northwest bank of Klamath River at an elevation of 400 feet. The bedrock is schist and the wash of medium size with a few large boulders on bedrock. It runs up

to 70 feet in depth.

The mine was formerly worked only on a small scale, and a great deal of preliminary work was required to permit enlarged operations. The company built a sawmill, constructed a dam on Camp Creek and built four miles of 5' x 3' flume capable of delivering 3000 inches of water to the penstock under 150-foot head. A deep bedrock cut was made for the upper end of the sluice. The sluice is substantially built, having a cross-section  $36'' \times 42''$  in depth and is approximately  $\frac{4}{10}$  of a mile in length. The lower 600 feet of the sluice has a grade of seven inches in 12 feet. The riffles are of 56-lb. rail, spaced on 5-inch centers, 380 feet of rail being required for this section. The upper end has a grade of five inches in 12 feet and the bottom is lined with  $\frac{5}{8}$ " thick steel plates,  $34\frac{1}{2}$ " x 36" in size, with a 3-inch riffle opening between the plates. The construction of this section differs from the usual practice, and is shown on the accompanying sketch. A 22-inch and a 15-inch pipe line delivers the water under 150-foot head to one No. 5 and one No. 3 Hendy giants. The water supply is adequate for a run of ten months annually under full head.

Piping of gravel was begun in March, 1925. The mine is being operated 24 hours per day, and an average of 2100 yards of gravel is handled daily. The gold averages \$17.75 fine. Fifteen men are

employed.

Bibl: State Mineralogist's Report XIV, p. 406.

Pearch Mine. This property, owned by P. L. Young, of Orleans, is located in Sec. 32, T. 11 N., R. 6 E., on Klamath River, about one mile northeast of Orleans. It was located about 50 years ago. Much gravel remains to be worked. It has been idle or worked only a little in the winter season in recent years.

Bibl: State Mineralogist's Report XIV, p. 404.

Red Porphyry Mine. Property consists of 90 acres in the Willow Creek district, in Sec. 17, T. 7 N., R. 5 E., two miles north of Willow Creek on the west bank of the Trinity River. Idle.

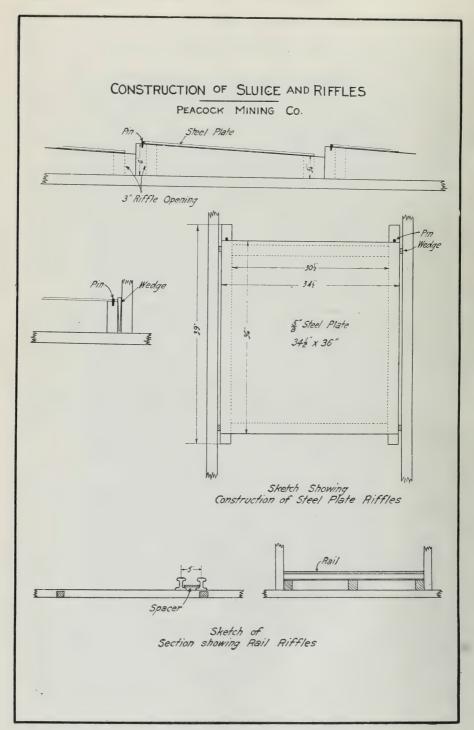
Bibl: State Mineralogist's Report XIV, p. 404.

Rocky Point Mine. Property consists of 60 acres covering bench gravels in Sec. 21, T. 11 N., R. 6 E., in the Orleans district. Elevation 500 feet. Wm. Wittmore, owner. Idle.

Bibl: State Mineralogist's Report XIV, p. 405.

Rosalina Placer Mine. Consists of two claims in T. 11 N., R. 6 E., on the northwest bank of the Klamath River, about eight miles from Orleans. There are two gravel benches both having slate bedrock. Water is brought in by \( \frac{1}{4} \) mile of flume and delivered under 400-foot pressure. The mine has been worked each winter for many years and operations are still continued for about three months each year. Owner, Lew Nelson, Orleans.

Bibl: State Mineralogist's Report XIV, p. 405.



Rough and Ready Placer Mine (formerly Rough and Ready and Sarvorum placer groups). Property includes 120 acres, a part of the Wilder Ranch owned by A. R. Wilder et al. This mine is located in Secs. 1, 2, 11 and 12, T. 10 N., R. 5 E., in the Orleans district, three miles southwest of Orleans. The deposit consists of bench gravel at an altitude of 500 feet. Water for working was formerly brought in by  $4\frac{3}{4}$  miles of ditch and flume. The flume was destroyed by fire several years ago, since which time there has been no water available for operations and the mine has been idle except for assessment work.

Bibl: State Mineralogist's Report XIV, p. 405.

Salstrom Placer Mine. (See Peacock Mining Co.)

Spanish Bar. One claim of 20 acres on a low bar of the Klamath River in Secs. 17 and 20, T. 10 N., R. 5 E. It is worked on a small scale during periods of low water by the owner, W. A. Taylor, Weitchpee, California.

Thompson Bar. Property consists of four claims about half-way between Weitchpec and Orleans, on the northwest bank of the Klamath, in Sec. 20, T. 10 N., R. 5 E. Water is obtained from Cap Creek, under 200-foot head, by  $2\frac{1}{2}$  miles of ditch and flume. The claims were located in 1907 by Wm. M. Salsbury. Now owned by Young Brothers of Weitchpec, who work it on a small scale.

Bibl: State Mineralogist's Report XIV, p. 406.

Weitchpec Bar Mine. This is a portion of the J. C. Gist holdings, located in the Weitchpec district in Sec. 10, T. 9 N., R. 4 E. It has not been worked much in recent years.

Bibl: State Mineralogist's Report XIV, p. 407.

Bibl. (Gold Placer Mines): State Mineralogist's Reports, VIII, pp. 216–223; X, pp. 205–208; XI. pp. 227–232; XII, pp. 132–135; XIII, pp. 172–179; XIV, pp. 401–407. State Min. Bur. Bull. 85; Bull. 92.

### GRAPHITE.

Impure graphite occurs on the South Fork of Trinity River, also in T. 10 N., R. 4 E., and a little has been found near Eureka. No development work has been done. The deposits are of doubtful value.

### IRON.

Both hematite, the most common iron ore, and magnetite occur in Humboldt County. The former occurs massive in veins, and as soft red ocher deposits. Magnetite is one of the principal constituents of the black sands. These deposits remain practically in the same condition as when first described in previous reports of the State Mineralogist. Data concerning them are briefly summarized herein.

Centerville Deposit. At a point on the coast, four miles south of Centerville, veins of hematite occur in metamorphic sandstone. A vein, eight feet in width, was exposed here years ago. This vein contained numerous thin seams of calcite, which made up about one-fourth its mass. It strikes east and dips 85° N. The ore is soft, of

brownish-red color and tends to scale off like micaceous iron. A mile north of here a vein of possibly better grade was indicated by boulders of hematite that showed no visible calcite, found on the shore. Large masses of float found between these two localities at the mouth of a little gulch gave evidence of a third vein in that vicinity. The latter two do not outcrop. Some of this ore was ground and used locally as a mineral paint in the past.

Preston Property. One of the most accessible showings is that found on property owned by W. A. Preston, Box 387, Arcata. This holding comprises 160 acres of patented land, the NE₁ of Sec. 28, T. 6 N., R. 1 E., adjoining the townsite of Arcata. The ridges crossing the property are covered with a deep layer of soil and a heavy growth of redwood, fir, alder and brush, so that it is difficult to determine the character of the formations. Apparently they are highly metamorphosed siliceous sandstones and shales, with much jasper. A laminated vein of fairly hard red hematite dipping to the east at about 65°, is exposed in a short tunnel and shallow inclined shaft, the latter partly caved. There are a number of other pits on this and the opposite side of the ridge that shows the ore to exist in an area of 60 acres, but the work so far done is too superficial to permit any estimate of the real size of the deposit. Selected samples of the ore are reported to have contained In one cut a small lens of low-grade manganese ore, 52% iron. assaying 23% manganese, was uncovered. Good clay is also found on this quarter-section. The elevation at the Preston iron deposit is 200 feet. It is only two miles from tide water and  $\frac{3}{4}$  of a mile from the railroad, and probably ranks as one of the best of the few iron deposits in the county.

Other occurrences noted are massive red hematite on Rainbow Ridge

and small amounts of specular hematite near Orleans.

Bibl: State Mineralogist's Report XII, p. 326; State Min. Bur. Bull. 91, p. 101.

# LIMESTONE.

Humboldt County is well supplied with limestone, but litle attention

has been paid to its development.

The deposits most accessible to Humboldt Bay are on Jacoby Creek, in Secs. 13 and 14, T. 5 N., R. 1 E., and Sec. 19, T. 5 N., R. 2 E. A test by Smith, Emery and Company, of San Francisco, on cement made from croppings at this locality showed it to have a tensile strength of 554 pounds developed at seven days, 778 pounds at 14 days, and 901 pounds at 28 days.

An analysis of limestone from an adjacent deposit on Jacoby Creek

gave the following result:1

SiO ₂	
Lime, CaO 53.61%; CaCO ₃	95.74%
$\mathrm{Fe_2O_3}$	
$Al_2O_3$	.56%
MgO	
Water	.01%
Residue and carbonaceous matter	.50%
	98.57%
Volatile, CO ₂ , H ₂ O, etc.	42.40%

¹ State Mineralogist's Report XIV, p. 394,

A large dike of limestone crosses in a northwesterly direction from Trinity County to Humboldt in T. 4 N., R. 5 E. It extends northwesterly, passing east of Horse Mountain and cutting across Willow Creek. Undeveloped deposits of good size are also found in the southeastern section of the county.

Bibl: State Mineralogist's Reports, IV, p. 109; VI, pp. 23, 98; VIII, p. 216; XIV, pp. 374, 393-394.

### MAGNESITE.

Magnesite is an important structural material of quite common occurrence in the serpentine belts of the Coast Range. It has been found in commercial quantities in several counties north of San Francisco Bay but was not known to occur in Humboldt County until recently.

Willow Creek Deposit. During the construction of the new road between Willow Creek and Hoopa the attention of highway engineers was attracted to small veins exposed in a cut. Samples were taken and the material proved to be magnesite. The deposit is of interest, but not believed to be of economic importance.

### MANGANESE.

Manganese was one of the 'war minerals' and intensive search for deposits of manganese ores during the war period resulted in the development of a number of deposits in Humboldt County. There was a fair production of commercial ore in 1918 and again in 1920. Operations are handicapped in most cases by long hauls over mountain roads.

Porter Ranch Deposit. This deposit is in the east central part of the county in T. 3 N., R. 4 E., about 30 miles by road east of Carlotta, a station on the Northwestern Pacific Railroad. Extensive beds of Franciscan jasper occur here, in which manganese oxides, mainly pyrolusite, are found. The ore is high grade carrying about 50% metallic manganese and 9% silica. It was under lease to L. M. Bryant in 1918.

Bibl: State Min. Bur. Bull. 76, pp. 33-34.

Woods Prospect. This deposit is in Sec. 3, T. 1 S., R. 4 E., 12 miles northwest of Blocksburg. The property is owned by Wilson Woods, of Harris, Humboldt County.

Haw Claim. W. H. Haw has recently located the Apex claim in Sec. 3, T. 1 S., R. 4 E., H. M., for manganese.

Herbert Robbins, 3790 Piedmont Avenue, Oakland, California, is the owner of a deposit of manganese reported to be large and highgrade. It is 15 miles from the railroad. Its exact location was not

. As noted under the heading 'Iron,' a small lens of manganese ore was exposed on the property of W. A. Preston, but its commercial value has not been determined. Bibl: State Min. Bur. Bull. 76, pp. 33-34.

#### MINERAL WATER.

Mineral water has been produced commercially in Humboldt County for many years, although the number of mineral springs is not great. The following springs have been described by Waring.¹ With the exception of Iaqua Medicinal Spring, they were not visited by the writer.

Cook Spring. This spring is 35 miles southeast of Eureka on the north bank of North Yager Creek, near the point where the road crosses the stream. The water contains sulphur and iron. It is not improved.

Felts Spring. Situated 5½ miles northeast of Fortuna, in T. 3 N., R. 1 E. There are three springs in the group yielding saline and sulphurated water. A hotel and resort was at one time maintained here.

Humboldt Artesian Mineral Well. This well was situated within the boiler-room of Flannagan's lumber mill, about one mile south of Eureka. It was 6 inches in diameter and 175 feet deep. The water was formerly bottled and carbonated and used as a table water for many years. It is an alkaline saline water.

Iaqua Medicinal Spring. Situated on the waterfront at the foot of K Street, Eureka. The mineral water at one time bubbled from the mud flats of the bay, but it has been cemented up and is now pumped from a well 20 feet deep and shipped in barrels to San Francisco, where it is bottled and placed on the market. Owned by Chas. E. Knight, 830 Market Street, San Francisco.

Mountain View Springs. This spring is located at a small resort on Mad River, 28 miles southeast of Eureka. The water is strongly sulphurated.

Bibl: State Mineralogist's Report XIV, pp. 408-410; U. S. Geol. Survey Water Supply Paper 338.

### NATURAL GAS.

A gas suitable for illuminating and fuel purposes flows from some of the wells in the oil district of the county. There are many instances where gas is escaping from oil seepages, but only in two cases is the gas in sufficient quantity to be useful for domestic purposes.

Frank Peters Gas Well. There are three springs on Frank Peters' land in the village of Capetown in Sec. 13, T. 1 N., R. 3 W. The gas is tanked and used in the house for lighting and fuel purposes.

Briceland Estate Gas Well. A gas well is located on this estate at the town of Briceland in Sec. 18, T. 4 S., R. 3 E. The well is 780 feet deep and has  $7\frac{5}{5}$ -inch casing. The well is capped and the gas is drawn off by a 1-inch pipe for lighting the houses of the town of Briceland. No storage tank is used, consequently the pressure is rather low after a few hours' use.

¹Waring, Gerald A., Springs of California, U. S. Geol. Survey Water Supply Paper, 338, 1915.

#### PETROLEUM.

For reasons mentioned in the Introduction, the present writer has not included the oil possibilities or development work in the Humboldt

County oil field in this report.

The petroleum resources, so far as they have been investigated by the State Mining Bureau, are discussed in the publications given in the bibliography. Current oil field operations are reported in 'Summary of Operations, California Oil Fields,' issued monthly by the Department of Petroleum and Gas of the State Mining Bureau.

Bibl: State Mineralogist's Reports, VII, pp. 195–200; VIII, p. 216; X, p. 207; XI, pp. 227–232; XIV, pp. 410–414. State Min. Bur. Bull. 19, pp. 161–166; Bull. 69, pp. 444–454; Bull. 89, pp. 40–43.

#### PLATINUM.

Platinum in small amounts is produced in the course of placer gold mining operations. The platinum resources of the county are described in detail by Logan.¹ The properties are noted herein under Gold (Placer Mines).

## SILVER.

Gettysburg Silver Mining Co. A company by this name with office in Reno, Nevada, located three claims in the Sawtooth Range, four miles from Sulphur, a few years ago. A 20-foot shaft on the Litharge claim is said to have cut a 4-foot vein of ore averaging \$35 per ton, most of the values being in silver, with a little gold. The vein was prospected for 1500 feet in length and showed a width of 4 to 10 feet. No recent information was obtained regarding this property.

### STONE INDUSTRY.

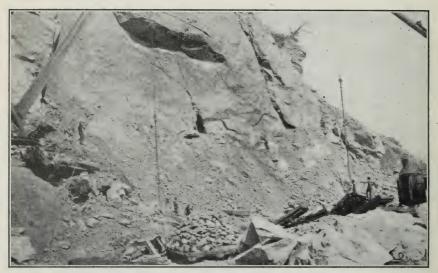
Large quantities of stone are being used as rip-rap in jetty construction at the entrance to Humboldt Bay. The crushed rock and gravel output enters into highway construction. Most of the plants producing these materials are located on or near the job, and are of a temporary nature, operating only until the work under contract is completed. There is but one company operating permanent commercial rock-crushing plants.

W. C. Elsemore, 432 W. Washington Street, Eureka, has a semi-portable rock-crushing plant at Freshwater, in Sec. 29, T 5 N., R. 1 E., five miles east of Eureka on the old Arcata road. It is operated intermittently in connection with his contracting business.

Engelhart Paving and Construction Co., office foot of S Street, Eureka. This company has operated a number of temporary crushed plants producing rock and gravel. Their plant on the highway at the point where it crosses Mad River, four miles north of Arcata, is now being dismantled.

Haw Quarry. This quarry is situated six miles from Eureka at an elevation of 150 feet, in Sec. 21, T 5 N., R. 1 E. The rock is a basalic

Logan, C. A., Platinum and Allied Metals in California, State Min. Bur. Bull. 85.



Coyote tunnel in quarry face (center) Medicine Rock Quarry, Humboldt County.



Medicine Rock Quarry, Humboldt County.

lava. It was formerly operated on a large scale, supplying much of the rock used on jetty construction at Eureka. Now owned by the city of Eureka. Idle.

Bibl: State Mineralogist's Report XIV, p. 392.

A. N. Hunt Quarry. Property is situated four miles north of Arcata. The deposit consists of granite boulders which were formerly used to a small extent for monumental purposes. There has been no production for many years.

Isaac Minor Quarry. Property situated on Warren Creek, a tributary of Mad River, in T. 6 N., R. 1 E. A granitic rock was mined here, suitable for building purposes, but utilized mainly for government work on the harbor jetty and as road rock. Owned by I. N. Minor and L. C. Everding, address, I. N. Minor, Glendale, Humboldt County. The property is idle, but equipped and in shape to resume operations.

Bibl: State Mineralogist's Report XIV, p. 393.

Jacoby Creek Quarry. This quarry on Jacoby Creek, five miles from Arcata, was formerly worked on a large scale by contractors supplying fill for the harbor jetty. The rock is a metamorphic sandstone. All equipment has been removed, and it is idle.

Bibl: State Mineralogist's Report XIV, p. 392.

Medicine Rock Quarry. This quarry was opened up in June, 1924, to supply rip-rap for the jetty under construction at the entrance to Humboldt Bay, by A. D. Kern, 290 East Salmon Street, Fulton, Oregon (A. D. Kern Construction Company). The quarry is on the property of the Hammon Lumber Company, at the end of the Northwestern Pacific Railroad, ³/₄ of a mile southeast of Trinidad. The rock which outcrops prominently is a greenish-gray, somewhat altered diorite. A small part of the output is crushed and screened to a product of from 1" to \(\frac{1}{4}\)", and sold for use on the state highway. There are five complete steam-operated derricks and hoists using crude oil for fuel; one locomotive crane, one Climax oil-burning locomotive, and a compressor plant with two compressors, operated by a semi-Diesel engine for supplying air for drilling. At the time of visit a coyote tunnel was just completed in the face of the quarry, and was being prepared to receive a charge of 1000 kegs of powder. The blocks as placed weigh up to 20 tons each. The camp is large and complete, 115 men being employed. It is estimated that there is about three years' work ahead on this job.

Mercer Fraser Co. James D. Fraser, president; J. L. Brown, secretary. Home office, 109 G Street, Eureka, California. This company operates two plants, one on Mad River at Essex, and the other on Eel River at Warwick, near Fernbridge. The Essex plant is operated by steam power. A ¾-yard Sauerman drag-line scraper is used for elevating the gravel. The material is crushed, washed and screened to two sizes, 2½″ to ¾″ and ¾″ to dust. The plant has a capacity of 100 yards per day. It is operated by two men. The material is loaded direct to railroad cars or trucks. The Warwick plant is the larger of the two. It is operated by electric power and has a capacity of 200

yards per day. A  $1\frac{1}{2}$ -cubic yard Sauerman drag-line scraper elevates the gravel to the plant where it is crushed, screened and washed. Three sizes are produced,  $1\frac{1}{2}$ " to  $\frac{3}{4}$ ",  $\frac{3}{4}$ " to  $\frac{1}{4}$ " and  $\frac{1}{4}$ " to dust. Two men are required for operating. The material may be loaded on railroad cars or trucks.

## VOLCANIC ASH.

Weatherby Ranch Deposit. On the property of the Hanify Lumber Company, under lease to Clarence Weatherby and adjoining the Weatherby Ranch four miles south of Elk River. A bed of fine, creamywhite volcanic ash, two feet in thickness, is found about half way to the top of a ridge running through the property. The strata are nearly horizontal and consist, so far as development has shown, of a capping of clay below which is the volcanic ash, then six feet of clay, two feet of lignite and another clay stratum of undetermined thickness. The deposit was opened up several years ago and the ash mined through a short adit run in on the bed. There has been no recent shipments. Its composition is given in the following analysis, by W. H. Gallagher, Eureka:

$SiO_2$	70.0%
$Al_2O_3$	
$\mathrm{Fe_2O_3}$	0.6%
CaO	3.4%
MgO	0.5%
K ₂ O	2.4%
Na ₂ O	3.4%
Undetermined	1.2%
Total	100.0%
_ V VV.	

The clay and coal have not been exploited. The property is within 4 mile of the Hanify Lumber Company's railroad.

## LOS ANGELES FIELD DIVISION.

W. BURLING TUCKER, Mining Engineer.

#### SAN DIEGO COUNTY.

#### Introduction.

San Diego was discovered in September, 1542, by Juan Rodriguez Cabrillo. This discovery of the San Diego region by Cabrillo was followed by the establishment of the first Franciscan Mission in California on June 16, 1769, by Padre Junipero Serra. The location of this Mission at San Diego led to the early settlement of the Pacific Coast and is of special prominence in the early history of California.

The county was one of the original twenty-seven counties organized in 1851 by act of the state legislature. In 1889 its area was considerably reduced by the formation of what is now Riverside County, and was further diminished in 1907 by the organization of its eastern por-

tion as Imperial County.

The principal industries are agriculture, stock raising, dairying, and commercial fisheries. The mining industry is relatively undeveloped, although the mineral resources of the county are varied and extensive. The rapid and continued growth of the city of San Diego, and the manufacturing industries on the Pacific Coast have led to the development of deposits of structural and industrial materials throughout the county.

### Description.

San Diego is bounded on the east by Imperial County, north by Riverside and Orange counties, west by the Pacific Ocean, and south by Mexico. Its area is 4221 square miles and its population 112.248

(census of 1920).

The county and the city of San Diego are served by two railroads, the Santa Fe and the San Diego and Arizona. The Santa Fe Railroad enters the county at San Onofre and follows the coastline to San Diego, connecting the latter with the city of Los Angeles. From the main trunk line there is a branch line from Los Angeles Junction, known as the Fallbrook branch that runs as far as Fallbrook; another branch line runs from Oceanside to Escondido, giving railroad transportation to an important citrus belt. The San Diego and Arizona Railroad runs along the border of Mexico and the county, connecting San Diego with Imperial Valley at El Centro. The Cuyamaca branch of this line runs from San Diego to Lakeside, affording transportation for El Cajon Valley and other interior points. From the port of San Diego regular steamer lines ply between San Diego, Los Angeles, San Francisco, Seattle.

San Diego has a wonderful system of highways and good roads which give access to all parts of the county. Two main paved highways from Los Angeles to San Diego parallel the coast. The coast route follows the coast line and the inland route is via Riverside, Fallbrook, and Escondido to San Diego. Two paved highways connect Imperial Valley with San Diego. Five scenic highways, stretching out from San Diego like ribs of a huge fan with its northern tip at Oceanside and its southern tip at Campo within one mile of the Mexican border afford easy access by automobile to all parts of the San Diego mountains. Each one of these intersects the road, forming the outer rim

of the fan which traverses practically the entire Incopah Range from northeast to southwest, a distance of more than 170 miles. The total mileage of all the fan-shaped routes is nearly 600 miles.

### Physiography.

The topographic features of the county consist of a series of parallel ranges of granite, with a southeast trend, including the southeastern continuation of the San Jacinto Range of Riverside County. Among these granite ranges are valleys occupied by parallel belts of metamorphic rock, chiefly slate and mica schist, with some quartzite and lentils of limestone. These have a general northwest strike, with steep dips to the east, and extend from Mexico into Riverside and Orange counties. The Cuvamaca and Laguna Mountain ranges extend northwest and southeast, and are over 5000 feet high at many points. Cuyamaca Peak has an elevation of 6515 feet, and Laguna Mountain, an elevation of 6500 feet. These are intrusions of diorite and gabbro which occur at intervals in the granite area. Southwesterly from this elevated belt the altitudes decline toward the coast. granite area is a belt of volcanic felsite and tuff, that extends northwest some 40 miles from the Mexican line. The belt is only a few miles wide, for the most part being buried beneath mesa formations. It is exposed at many points, forming the peaks of Otay, San Miguel, and Black Mountains. The mesas of Tertiary deposits which occur on the west flank of the crystalline formations gently slope seaward, from an altitude of about 500 feet at its eastern margin to an elevation of about 300 feet near the coast line. From the main divide the surface slopes steeply eastward toward the Salton Basin.

The principal valleys of the county are those occupied by the Santa Margarita, San Luis Rey, San Dieguito, San Diego, Sweetwater, Otay, and Tia Juana rivers. They are characterized by wide, flat, gently-sloping floors, bordered by steep slopes or bluffs several hundred feet high and they contain streams that rise far back in the mountain area. All these streams flow to the ocean. El Cajon Valley, Santa Maria Valley, and Warner Valley are comparatively flat tracts, some of them surrounded by steep mountain walls, and cover many square miles. within the highland area, and form the broad valleys.

### Geology.

The geology of San Diego County has been described in detail by W. A. Goodyear in the Eighth Annual Report of the State Mineralogist, pp. 516–528, for the year 1888; by Harold W. Fairbanks in the Eleventh Report, pp. 76–120, for the year 1892; by Dr. F. J. H. Merrill in the Fourteenth Report of the State Mineralogist, pp. 637–645, for the years 1913 and 1914; in Water Supply Paper No. 446, U. S. Geological Survey, 'Geology and Ground Waters of the Western Part of San Diego County.' The reader is therefore referred to the above publications, in which the geology of the region has been covered in more detail than will be attempted by the present writer, as the principal purpose of this report is to present data pertaining to the minerals of the county so far as they have been investigated by the State Mining Bureau, in the hope that their development and utilization may be hastened.

The formations of San Diego County are granites and other igneous crystalline rocks of several ages, metamorphic strata of great age, possibly Carboniferous or older, and sandstones, shales, conglomerates,

sands, gravel, and clays of Mesozoic and Tertiary age.

The granites upon which the metamorphic rocks rest, and by which they are intruded are of several types. These granites are in turn intruded here and there by basic rocks of the diorite and gabbro types. The latter are cut at many points by pegmatite dikes which also appear as intrusives in the schists and in the granites. Two areas of these basic intrusives form substantial mountain ranges, one traversing the Cuyamaca Grant from north to south, and forming three peaks, of which the southermost, 6515 feet high, is known as Mount Cuyamaca. Ten miles southeast is a diorite ridge, known as Laguna Mountain, of which the summit attains an altitude of over 6500 feet.

On the southwest flank of the granite area is a volcanic flow, a few miles wide, extending northwest some 40 miles from the Mexican boundary. This area is largely overlain by Tertiary formations. The principal rocks exposed are felsite, tuffs, and volcanic conglomerates. The metamorphic formations are mica schists, slates, quartzites, and limestone; the mica schists are well exposed at Julian and on the west flank of the Laguna range of mountains. The Cretaceous strata exposed in this region are of the Chico series and appear in the bluffs on Point Loma and at La Jolla as described by Harold W. Fairbanks in the Eleventh Report of the State Mineralogist, p. 95.

The earlier Tertiary or Eocene deposits appear at the surface from Los Peñasquitos Canyon northward to Buena Vista Creek; the later Tertiary deposits are exposed from Los Peñasquitos Canyon southward to the Mexican boundary, and from Buena Vista Creek northward to the north boundary of the county. The earlier Tertiary or Eocene beds are made up of white sandstone, underlain by alternating layers of shale, sandstone, and thin layers of clay and shale, limestone and

sandstone, and marl and calcareous material.

#### Mineral Resources.

The last general report on the mines and mineral resources of San Diego County appeared in the Fourteenth Report of the State Mineralogist (1913-1914). The writer of the present article spent from May 18 to July 1, 1925, on a survey of the county in an endeavor to collect up-to-date information on all mining activities and mineral resources, with the exception of the clay deposits which were visited by Mr. W. F. Dietrich of Stanford University, who is compiling a report on the 'Clay Resources of California,' which will be published by the State Mining Bureau at a later date. Therefore, in this paper only a brief report will be attempted on the various deposits of clay throughout the county. Appreciation is here expressed for the courteous treatment and cooperation of operators, owners, and the Chambers of Commerce throughout the county. Acknowledgments are especially due to Mr. H. R. Jackson, Industrial Manager of the San Diego Chamber of Commerce; Mr. Claus Spreckels, of the San Diego Electric Railway Company; Mr. J. B. Current, of San Diego; John and Thomas Noble, of Descanso; L. E. Keger, of San Diego; M. C. Turner, of San Diego; J. W. Mykrantz, of Ramona; W. H. Knowles, of San Diego; P. J. Kane and C. W. Curry,

of Julian, for their cooperation and for the valuable information which

they furnished.

San Diego ranks twenty-fifth in the total value of its mineral output, and tied for second place with Los Angeles County in point of variety, with a record of 17 different commercial minerals for the year 1923. The value for 1923 amounted to \$821,776, as compared with the 1922 output worth \$656,807. In 1918, for the only time in several years, there was no production of gems, in which San Diego County has led the state. The minerals commercially produced are as follows: Brick, clay, feldspar, fuller's earth, gems, gold, granite, lithia, lead, magnesium chloride, marble, mineral water, molding sand, salt, silica, silver, and stone. Aside from the minerals commercially produced. San Diego contains occurrences of bismuth, graphite, marble, nickel, soapstone, tin, and tungsten (scheelite). Potash has been produced from kelp. A development of recent years is the shipping of pebbles for grinding mills. The attached table gives the complete recorded output and value of the mineral production of the county from the earliest available record for 1880 to and including 1923.

# SAN DIEGO COUNTY MINERAL PRODUCTION, 1880-1923.

PINISICAL TOURNOES PRATRY

ř.	· ·	Gold	Silver,	Bri	ck	Gems,	Granite	Mineral water		Salt		Miscel-	Miscellaneous and unapportioned		
	Year	value	value	M.	Value	value	value	Gallons	Value	Tons	Valu e	stone ¹ , value	Amount	Value	Substance
1	880	\$81,558 60,000													
1	883.	100,000 50,000	\$5,000												
1	885	65,000 95,125	5,000 2,000												
]	886	140,450 66,900	78,758 198,537												
]	888	160,000 275,440	192 000 25,740												
	890	453,800 467,000	100							*****					*** *** **** ***** ***** *****
1	893	396,518 105,860	2,051							700	es 000	040.074	EQ 4ams	80.050	table.
	894	266,409 341,308	190 600	1				48,000	\$11,500	700 700	\$5,000 5,000	\$49,374 25,000	50 tons		Asbestos.
1	1896	560,578 592,328	300	672	20,000		04.075	45,000 25,000	35,000 5,000	600	4,800 5,850	3,573 23,390			
	898	673,196 333,650	300	860	\$2,688 4,300		\$1,875 8,150	4,320 12,000	3,000 6,000	600	5,000	5,359 18,198	( 3,100 lbs.	1,317	Lead.
1	900	335,937	29,500	734	3,261	\$500	9,900	6,500	3,250	600	4,000	14,403	125 tons 440 tons	4,600 11,000	Lithia mica. Lithia mica.
1	901	413,320 338,877	² 2,800 1,994	1,158 688	5,791 3,440	20,000 150 000	22,400 13,175	6,000 5,158	3,000 1,289	1,060 7,900	9,620 7,900	6,887 14,175	1,100 tons 822 tons	27,500 31,880	Lithia mica. Lithia mica.
1	903	461,516 334,697	1,444	2,150 3,824	11,150 23,700	100,000 136,000	16,308 7,851	6,000	3,000			42,597 200,192	700 tons 641 tons	27,300 25,000	Lithia mica. Lithia mica.
	905.	109,712	100	3,190	28,350	66,000	10,250			0.000	F 000	16,507	4,808 lbs. 25 tons	750 276	Copper. Lithia mica.
	907	7,455	35	3,950 4,474	34,900 36,430	284,500 206 336	10,250 23,650	2,000	2,000	6,000 7,000	5,000 55,000	4£,738 28,500	(13,246 lbs. 971 lbs.	2,659 52	Copper. Lead.
	908	6,920	86	2,112	16,719	121,500	10,000	9,810	11,772	7,000	60,000	37,122	4,000 cu.ft		Marble.
]	909	12,812	1,721	5,844 8,813	38,946 62,647	125,000 110,300	10,000	10,210 40,550	12,022 30,110	15,000 8,000	60,000 24,000	33,510 147,817		214,634	Unapportioned 1900-1909.
1	911 912	4		9,500 10,500	68,000 80,000	25,000 12 500		60,090 52,060	87,020 17,218	13,000 12,450	37,500 31,350	201,488	403 tons	500	Pottery clay.
1	913			9,384 5,457	68,400 56,392	7,465 1,150		41,500 8,865	15,225 911	20,500 15,300	51,750 46,200	170,014 210,250	838 tons 30 lbs.	2,840	Pottery clay. Copper.
	915		g	1,260	21,025	2,465		10,350	1,035	17,616	19,616	163,723	3,008 lbs.	1,365 526	Other minerals. Copper.
		.,,,,,			=1,0=0	9,110		10,000	2,000	21,010	10,010	200,120	23 lbs. 2,150 tons	1 175,804	Lead Potash
1	916			4,001	36,812	2,710	3	3		3		163,925	16,806 lbs.	4,134 13,140	Copper. Gramte, lithia, mineral water,
													283 tons	613	salt. Pottery clay.
1	917		1	and	tile 21,423	1	1	3		4,500	9,750	125,855	153,349 lbs. 5,252 tons	43,502	Copper. Potash.
										.,,,,,	0,130			21,055	Pottery clay, gems, granite, lithia, mineral water, molyb-
													4,143 lbs	1,023	denum, silica, eilver. Copper.
	1918	:-			29,080	-	1	j j		10,631	61,717	184,158	700 tons 10,372 tons	3 600 1,578,874	Feldspar. Potash.
														83,698 62 929	Gramte, lithia, mineral water. Clay and clay products.
	1919	1,470	12		3	3	15,215	3		12,400	52,800	141,996		40 800	Copper, gems, lithia, mineral water, potash, silica.
													5,852 tons 2,953 tons	57,522 17,715	Pottery clay. Feldspar.
I	920				87,612	2,100	7,838			15,300	77,100	333,847	7,557 tons	18,893 191,602	Silica (glass sand). Lithia, magnesium salts, mineral
														,002	water, tantalum ore (colum- bite.)
													370 tons	92,600 725	Clay and clay products. Glass sand.
]	921	3	2		3	1,405	22,444	70,924	9,161	3		187,922	1,850 tons	11,100 176,036	Feldspar. Gold, lithia, magnesium salts,
													3,500 tons	29,500	marble, salt, silver. Feldspar.
	1022	3	2			400	35,673	71,781	9,262	3		355,810		93,045 133,117	Clay and clay products. Fuller's earth, gold, lithia,
								,				,			magnesium salts, marble, salt, silica, silver.
	ı may												5,603 tons 6,100 tons	100,977 42,800	Pottery clay. Feldspar.
	1923.	822	1##		a	8,530	40,600	59,795	6,570			343 959		277,394	Brick and tile, Fuller's earth, lead, magnesium chloride,
													(12,783 tons	36,941	marble, salt, silica (quartz). Pottery, clay.
1	924	4,830	97		232,113	1,925	94,006	107,097	8,642	3		379,094	6,850 tons	47,950 2,269	Feldspar. Lithia
														205,252	Arseme, Fuller's earth, magne-
	Totals	387,317,852	1\$528,358	78,571	45973,209	*\$1,385,78.	\$352,585	3702,010	\$281,987	3178,107	\$643,953	\$3,842,498		\$5,451,177	FHYSICAL
-	Includes crushed rock, rubble,	fin-ppp co-1	ground -	hlaal				-04	1 1**						SC!ENCE3
	2Recalculated to 'commercial,'	from 'coming'	value, as origi	g olocks, grind) nally published	ng-mill pebble L	4 1		See un Includ	der 'Unappo ed under Imj	rtioned.' perial Count	y production	n.			LLRARY

Includes crushed rock, rubble, rip-rap, sand, gravel, paving blocks, grinding-mill pebbles - ²Recalculated to 'commercial,' from 'coining value,' as originally published.

See under 'Unapportioned.'
Included under Imperial County production.



### METALS.

#### ARSENIC.

Arsenic is found in a number of localities in San Diego County in the minerals arsenopyrite (FeAsS), and scorodite, an oxidization product of arsenopyrite. The principal occurrences noted were in the Black Mountain and in the Laguna districts. At the Black Mountain Mine, located southwest of Escondido, some development has been done, and an attempt made to make a commercial product by concentration. It is principally used for the preparation of insecticides for agricultural and horticultural purposes, and especially against the cotton boll weevil in the southern states.

Black Mountain Mine is located in Sec. 5, T. 14 S., R. 2 W., S. B. M., nine miles southwest of Escondido on the north slope of Black Mountain. Elevation 1000 feet. Holdings consist of four claims known as the Black Mountain Group, a total of 80 acres. Owners, Black Mountain Arsenic Company; Wilfred Buckland, president; Eugene Overton, secretary; F. C. Hopkins, manager. Offices, 1300 Stock Exchange Building, Los Angeles.

The ore occurs as arsenopyrite, in two parallel dikes of quartzite that cut the diorite, with a general northwest strike, and a dip to the northeast. These dikes are from 10 to 15 feet wide. The arsenopyrite associated with pyrite occurs in the form of lenses, and also is finely disseminated throughout the fractures and seams in the quartzite.

Development consists of a tunnel 30 feet in length, two shafts 40 feet deep, and a number of opencuts made along the outcrops of the quartzite dikes. The mine run of ore extracted from the tunnel is reported to average 5% arsenic, with from \$2 to \$5 in gold per ton. During 1924 a 20-ton concentration plant was installed, but milling operations were suspended in July, 1924, on account of lack of water.

Mine equipment consists of a 7½" x 6" Chicago pneumatic compres-

sor, and air drills.

Mill: One 7" x 9" Blake crusher, 20-ton Herman ball mill, and a Universal Overstrom concentrator. The plant is driven by a 70-h.p. Holt tractor gas engine.

The concentrates produced are stated to carry 40% arsenic with

gold values. Two men are employed on development work.

Arsenic also occurs as arsenopyrite in the quartz veins of the Willhite Group of claims, located on the west slope of the Laguna Range. about nine miles east of Descanso.

#### BERYLLIUM.

A number of varieties of beryllium minerals are to be found, but none have been found in commercial quantities except beryl, which is a silicate of beryllium and aluminum, carrying when pure 57% silica, 19% alumina, and 14% beryllium oxide. Beryl occurs in San Diego County in the pegmatite dikes of the tourmaline-gem district in the northern part of the county. Thus far no commercial shipments have been made except for gem purposes (the pink and aquamarine varieties). To be suitable for commercial purposes it should carry from 10% to 12% beryllium oxide.

After the ore is mined it is ground to pass 90-95% through a 200-mesh screen. It should be white in color, free from iron-bearing minerals and metallic iron. The price varies from  $4\phi$  to  $5\phi$  per pound in carload lots, according to demand and the percentage of beryllium oxide.

The chief use at present for ground beryl is as an addition to porcelain products, where it reduces the coefficient of expansion. Beryllium metal is difficult to separate from aluminum. For this reason the mineral phenacite ( $\mathrm{Be_2SiO_4}$ ) would be a more desirable source for the metal, as it carries approximately 45% beryllium oxide.

### BISMUTH.

This metal has been found in small quantities associated with amblygonite in the lithia vein at Pala. It occurs both as native bismuth and as an oxide. Small samples of native bismuth have been reported from other points, especially near Jacumba. It is used in fusible alloys for electric fuses, for protecting boilers etc., in painting glass and porcelain, and in medicine.

#### COPPER.

Copper minerals occur in association with the ores of other metals quite extensively throughout the county, but no large deposits have as yet been developed. This metal has been found at several points in the hills between Escondido and Encinitas. Some of the claims near Escondido are being held by assessment work, but the old Encinitas

Copper Mine has not been worked for a number of years.

On the San Vicente Grant copper minerals occur in a mineralized zone on the contact of granite and schist. Surface croppings show brown oxides of copper, malachite, and some azurite. Below the oxidized zone a sulphide zone was encountered, and chalcopyrite associated with pyrite is finely disseminated throughout the schist. This deposit was formerly known as the Barona Mine, and is now being worked by the Southern California Mining and Smelting Company, of San Diego. Chalcopyrite carrying gold has been found in small quantities on the east slope of Barber Mountain northeast of Dulzura. Southwest of Julian the Friday Mine, owned by the Friday Copper Mining Company, of San Diego, shows a small percentage of copper sulphides and carbonates along the gossan outcrop. The ore developed in the mine shows only a trace of copper. From surface indications, with the exception of the Daley Mine southwest of Ramona, it seems improbable that anyone of the deposits thus far known has sufficient magnitude to develop into a copper mine of much importance, though some may yield limited quantities of commercial ore.

Daley Copper Mine comprises 100 acres of patented land located in Sec. 11, T. 13 S., R. 1 E., S. B. M., seven miles southwest of Ramona. Elevation 1650 feet. Owner, Sarah M. Daley, of San Diego. Under option to the Southern California Mining and Smelting Company; George W. Lindsay, president; J. W. Ott, secretary; M. W. Tanner, superintendent, San Diego.

This deposit was discovered in 1894 and operated from 1915 to 1916, by the San Jacinto Mining and Milling Company. In 1916 it was bonded to the Southern California Mining and Smelting Company, of

San Diego, which operated the property until December, 1923, and

then after a short shutdown resumed operations.

A mineralized zone about 150 feet in length by 50 feet in width occurs on a contact of granite and schist. Surface croppings show brown oxides of copper, malachite, and some azurite. The oxidized zone has a depth of 30 feet. Here the sulphide zone was encountered; the ore occurs as chalcopyrite associated with pyrite and is finely disseminated throughout the schist. It is stated that the ore mined will average from 2% to 3% copper, with 6 oz. silver. The mineralized schist is cut by a porphyry dike 12 to 15 feet wide, which strikes N. 50° E., with a dip of 70° NW.

Development consists of a vertical shaft 115 feet deep. A crosscut tunnel driven southeast 50 feet connects with the shaft 50 feet below

the surface.

Mine equipment consists of a 12-h.p. gas engine hoist,  $4\frac{1}{2}$ " x  $4\frac{1}{2}$ " Rix compressor, cars, and air drills. The company is installing a 50-ton concentration plant. Fifteen men are employed.

Bibl: State Mining Bureau Bulletin No. 50, p. 345; State Mineralogist's Report XX, p. 370.

Encinitas Copper Mine is located in Sec. 28, T. 13 S., R. 3 W., S. B. M., eight miles east of Encinitas. The mine was formerly operated by the Encinitas Copper Company, of San Diego. Holdings comprise 20 claims, and the croppings on these claims show the presence of

copper.

Development consists of two shafts 200 feet apart, and a tunnel. One shaft is reported to have a depth of 280 feet, the other 100 feet. These shafts were sunk on a vein three feet in width in a porphyry formation. The ore is chalcopyrite associated with pyrite. The property has been idle for years.

Bibl: State Mining Bureau Bulletin No. 50, p. 344.

#### GOLD.

Since publication of the Fourteenth Report of the State Mineralogist in 1914, there has been a revival of interest in gold mining throughout the county, the principal districts affected being Boulder Creek, Laguna, Deer Park, and Julian, where there has been considerable prospecting and some of the old properties are being reopened.

The principal gold belt extends southward a distance of 45 miles from the Montezuma district, east of Warner to the Mexican border. The most productive district has been the Julian-Banner district. This district is 55 miles northeast of San Diego by paved highway, and about 35 miles from Foster, the terminus of the San Diego and Arizona Railroad. A new road which connects with Imperial Valley has been built from Julian to Banner. This road will prove of great benefit to the mines located east of Julian.

# History.

Gold has been known in this district since a very early period, and placers were worked in the neighboring gulches for some years before the precious metal was found in veins. The first vein discovery is said to have been made in 1869 on what was afterward the Van Wert

On February 22, 1870, another vein was discovered, and a claim located on it under the name of Washington. From 1870 to 1880 there was great activity in this district, and the production of gold is estimated at over \$2,500,000.

# General Geology.

The country rock is a metamorphic slate or mica schist with a northwesterly strike and a nearly vertical dip. At some points it has been injected with granitic material in thin sheets parallel to the feliation of the schist. When this occurs a rock results which closely resembles a granitic gneiss. Small intrusive areas of granite also appear. The mineralization of this area is in fissure veins of quartz, which, both in dip and strike, are generally parallel to the schistosity of the country rock. These veins are essentially 'stringer leads' and are usually small in width, following the curving strike of the schists as these swing westward toward Julian.

Several parallel veins have been recognized, four of which have been regarded as continuous for several miles. The farthest east is known as the Chariot vein; those succeeding westward being known as the Ready Relief, Cable and Ruby.

In the Boulder Creek district the auriferous quartz veins are in a narrow belt of mica schist and granite. In the Descanso and Deer

Park districts the quartz veins are in the granite.

The Laguna district is on the west slope of the Laguna range of mountains. Here the quartz veins are in a belt of micaceous schist one mile in width, which has a general northwest strike, and is about two miles in length along the course of the belt.

Some activity in placer mining is shown on Coleman and Banner creeks. In the former the gravels are being worked in a small way, and it is stated that the operators are making fair wages. Creek a number of drill holes have been put down by John L. Hall, on the San Felipe Ranch. It is stated that samples taken from the

various test holes ran from 30 cents to \$1.50 per yard.

F. C. Hopkins and associates of Escondido have done considerable prospecting along the old river channel known as the Ballena Placer in Sec. 17, T. 13 S., R. 2 E., and also on the San Vicente Grant. southeast of Ramona. The gravel is said to carry from 30 cents to \$1.50 per yard. A screening and washing plant having a capacity of fifty tons has been installed.

### Mines.

Ballena Placer. This deposit of auriferous gravel, located southeast and east of Ramona, is an old river bed with a southwesterly trend, belonging to a system of drainage now extinct and possibly of Tertiary The gold may have come from the region about Julian. As described by Fairbanks:1

"It is not generally known that an ancient auriferous gravel channel exists in the county. It begins about a mile north of the old stage station, and three miles west of Ballena Post Office where there rises a hill shaped like a whale's back (hence the name Ballena), covered with washed gravel and boulders. The main portion of the channel which has escaped erosion begins south of the stage station, capping a hill which has an elevation above the sea of 2400 feet, being a little lower than the so-called Whale Mountain. The gravel is 50 to 100 feet thick, and has a width of

¹ Fairbanks, H. W., Geology of San Diego County: State Mineralogist's Report XI, pp. 91-92, 1892.

2000 feet or more. It rises 300 to 500 feet above the valleys and canyons on its sides. It extends in a direction a little south of west for about four miles, terminaring on the south of Santa Maria Valley. A granite ridge runs two or three miles farther in the same direction, probably preserved by the gravels, which are now gone. A pretty valley, a mile long, has been croded in the eastern end of the gravels, down the underlying granite. Placer mining has been carried on for years here in a small way by Mexicans. Gold is said to be scattered everywhere through the gravels, which are often very firmly cemented. Lack of water, for the ridge is higher than any of the surrounding country, has prevented work on a large scale. The gravels are washed boulders, many of them two feet in diameter and well polished. The remarkable thing about them, however, is that they are nearly all porphyries. The most abundant is a red feldspar-quartz porphyry. Quartzite boulders of all colors are numerous, and there are a few of the basic diorite so common in portions of the county. Garnets are said to be very abundant in the gravels, and many boulders of a schist carrying them are present. The matrix of this rock could not be made out in the field; it is very tough and heavy, and has never been seen in place. The red porphyry boulders resemble those on the meas farther west, but have never been found in place. Never, in the mountains east or north, has porphyry of this kind been seen, either by myself or described by others. From the old stage station the upper course of the stream was north and south as far as it can be traced. There are indications that one branch extended easterly toward Julian. These gravels appear on a hill surrounded by deep canyons, about two miles east of the top of the grade above Foster's. At the top of the grade the hills on the west are flat-topped, and covered whether the course of the sold stream was down toward the San Diego River, in Cajon Valley, or west toward the high meass south and southeast of

The most productive area is located in parts of Secs. 17, 18, 19, 20, and 21, T. 13 S., R. 2 E., S. B. M. This ground, comprising 600 acres, is owned by John Johnson, of Escondido. Pay gravel also occurs in Sec. 16, on the F. R. Sawday Ranch, and extends south into the San Vicente Grant, owned by J. W. Mykrantz, of Ramona.

The gold occurring in the gulches on the San Vicente Grant has evidently been distributed by erosion from the channel exposed on the range of mountains that lies between San Vicente Valley and Santa

Maria Valley.

F. C. Hopkins Placer Mining Company, of Escondido, has a lease and bond on the 600 acres owned by John Johnson.

The present operations are being carried on in Granite Creek, at the point where Mr. C. F. Willard, of Ramona, started operations in

1906, and operated off and on until 1914.

The width of the channel at this point is about three-fourths of a mile, and it is said to have an average thickness of 30 feet, with values averaging 30 cents per yard, while richer streaks and channels carry as high as \$1.50 per yard. The gold is fine and occurs all through the gravel from the surface to bedrock and does not appear to be any richer at bedrock than in the upper gravel. Mr. F. C. Hopkins expects to have the washing plant under operation during the month of July, all depending on the development of water in the bed of Granite Creek.

The plant for treatment of the gravel consists of a 4' x 16' revolving screen, where the gravel is screened to 1-inch size; oversize gravel is rejected. From this screen the finer dirt passes to a revolving drum containing riffles, which is set over a large tank containing over 2000 gallons of water. In this tank agitators mounted on endless chains dissolve the dirt and carry out the pebbles and the coarse sand, leaving the finer sediment carrying the gold to settle at the bottom of the tank.

The screens are operated by two gasoline engines. A gasoline-driven P. & H. shovel delivers the gravel from the channel to the plant. The screening and washing plant is so constructed that it can be moved along the channel by means of a tractor. Pannings taken along the channel by the writer show the presence of five to ten colors of gold to the pan. The gold is quite fine, but very bright. Mr. Hopkins has sunk numerous prospect holes and trenches along the channel on Granite Creek, and also on the San Vicente Ranch, and the results of these test holes warrant the exploration of these gold-bearing gravels. It will be interesting to learn of the final results after the plant is under operation. The main difficulty will be due to lack of water. Six men are employed.

Boulder Creek Mines comprise ten claims located on the south slope of Mineral Range and north of Boulder Creek, in Secs. 9 and 10, T. 14 S., R. 3 E., S. B. M., 14 miles southwest of Julian. Elevation 2500 feet. Owner, Boulder Creek Consolidated Gold Mining and Milling Company; Thomas J. Fisher, president; George Mayer, vice president; J. H. Kleine, secretary, Lakeside.

The vein occurs in a narrow belt of schist in the granite. The vein strikes N. 30° W., dips 80° W., and has an average width of three feet. The ore shoots are short being from 20 to 30 feet in length. Average value of the ore is said to be \$6 to \$12 per ton. The quartz

shows free gold associated with pyrite and arsenopyrite.

The properties are developed by 2000 feet of tunnels and drifts. The lower tunnel is driven as a crosscut 80 feet north to the vein, and a drift run 160 feet N. 30° W. on the vein. At the intersection of the crosscut and the drift a winze has been sunk on the vein to a depth of 30 feet. Here the vein has a width of three feet, and is said to average \$7 in gold per ton. At 50 feet above this tunnel, another tunnel has been driven on the vein 360 feet. Sixty feet above No. 2, a third tunnel has been driven N. 30° W. 150 feet on the vein.

The ore shoots developed in these workings are about 50 feet apart along the strike of the vein, but are short, being only about 20 feet in length. Ore shoots have been stoped to the surface above No. 2 and No. 3 tunnels. It is said that the ore mined plated \$14 per ton in gold

with a loss of \$5 per ton in tailings.

Mill equipment consists of 6" x 9" Blake crusher and Lane mill driven by a 20-h.p. gas engine. Two men are employed.

The Brown Group of claims comprises four claims known as Santen, Trixie, Lottie, and Laura, located in Sec. 9, T. 15 S., R. 5 E., S. B. M., in the Laguna range of mountains, nine miles east of Descanso.

These claims lie west of the Frances group. Two parallel veins occur in the schist near the west contact of the granite. The veins strike N. 30° W., and dip 50° to 60° NE. They have a width of from 4 to 8 feet.

Development work consists of prospect holes and opencuts made at intervals along the outcrop of veins. J. J. Brown, of San Diego, owner.

Cleveland-Pacific Mine (Escondido Mine). The property is located two miles southeast of Escondido in Lots 2 and 4 of Block 257, and Lot 4 of Block 188. This mine is on the Rincon del Diablo Grant, purchased in 1884 by the Escondido Town and Land Company. The property was operated by early Spaniards or Mexicans. About 1868 it was worked by Americans with an arastra. In 1897 it was taken over and operated by the Cleveland-Pacific Mining Company until 1911. The reported production of the mine is about \$250,000. In 1924 B. F. Brough and associates, of Toledo, Ohio, secured an option on 120 acres.

The vein which is said to vary in width from a few inches to three feet, occurs in granodiorite with a strike of N. 40° E., and dip about 40° westerly. The Cleveland-Pacific Mining Company sunk an incline shaft on the vein to a depth of 350 feet. The drifts on the vein from

this shaft amounted to 500 feet.

The present operators have sunk a two-compartment vertical shaft about 500 feet southwest of the old shaft to a depth of 160 feet. At a depth of 150 feet a crosscut was driven to the vein, and it is reported that 450 feet of drifts were run to the northeast. The vein cut on this level is said to be six feet in width, and is made up of quartz and tale. The ore is said to assay from \$7 to \$50 per ton, the quartz being heavily mineralized with pyrite.

Equipment consists of a 25-h.p. electric hoist, Sullivan compressor driven by a 30-h.p. motor. Eight men are employed. J. W. McLeod,

superintendent.

Bibl: State Mineralogist's Reports, VIII, pp. 524–525; XI, p. 382; XII, p. 240; XIII, p. 336; XIV, p. 650.

Descanso Mine (Ellis Mine) comprises 17 claims located in Sec. 24, T. 15 S., R. 3 E., near the town of Descanso. Elevation 3500 feet.

Owner, Mrs. A. B. E. Shute, of Descanso.

A series of parallel veins of quartz occur in the granite, the general course being east. Practically all the development work has been confined to the Magdalena vein, which dips 80° N. An incline shaft has been sunk on the vein to a depth of 230 feet. The vein developed varies in width from 12 inches to 3 feet. The quartz shows a small percentage of free gold associated with pyrite, marcasite, galena, and pyrrhotite. The vein has been drifted on 80 feet west on three levels above the 200-foot level. The ore developed is said to assay from \$10 to \$50 per ton in gold.

Equipment: A 15-h.p. gas engine hoist, 8" x 8" Fairbanks-Morse compressor driven by a 25-h.p. Western gas engine, blacksmith shop,

cars, air drills, and a Cameron pump. Two men are employed.

Eagle Mine comprises one claim located one mile east of Julian in Sec. 5, T. 13 S., R. 4 E., S. B. M., Julian mining district. Elevation 4200 feet. Owner, A. P. Frary, of Julian. Under lease to G. Dodge, of Julian.

Two parallel veins occur in the schist, and have a general northwest strike, with a dip of  $60^{\circ}$  to the east. These veins have an average width of 12 inches.

Development consists of two tunnels and a shaft 100 feet deep. The lower tunnel is a crosscut driven N. 10° E. for 300 feet. At 50

feet from the portal the first vein is cut, which was drifted on 75 feet northwest, and 50 feet southeast, and stoped to the surface. The second vein was intersected at 120 feet north, with a drift on the vein 150 feet to the northwest. This vein was also stoped to the surface. About 200 feet west of this tunnel, at a higher elevation, a tunnel has been driven N. 40° W. on the first vein, a distance of 300 feet. Several winzes and raises have been made on the vein which is 8 to 12 inches wide. The ore mined is said to have an average value of \$25 per ton in gold. A two-stamp mill is being installed. Two men are employed.

Bibl: State Mineralogist's Report XIII, p. 335.

Elk and Landslide Claims are located in Sec. 3, T. 14 S., R. 3 E., S. B. M., on Kelly Creek, a tributary of Boulder Creek, one mile southwest of Anahuac Ranch, and 12 miles south of Julian. Owners, R. D. and B. F. Moore, of Julian.

The Elk vein is six feet wide, and strikes N. 20° W. Quartz shows free gold associated with pyrite and arsenopyrite. Landslide vein has an east and west course, and a width of 12 inches to 2 feet. Both veins are in granite.

Development consists of a number of prospect holes along the outcrops.

Ester Group of claims is located in the Laguna mining district, about 10 miles east of Descanso, and north of the Melba group of mines. The group comprises three claims. Owner, James Fox, Guatay. The veins occur in schist, and strike N. 20° W. Prospect.

Expansion Group of claims is located in Sec. 31, T. 14 S., R. 5 E., S. B. M., in Harper Canyon, in the Deer Park mining district, about nine miles northeast of Descanso. The group comprises four claims. A series of parallel veins occur in the granite with a general northwest strike. Prospect. Only shallow workings along outcrops of the veins.

Frances Group of claims is located on the west slope of the Laguna range of mountains, in the Laguna mining district. The group comprises the Frances, Ruth, Anna, Kitty, Nellie, and Nora claims, in Sec. 9, T. 15 S., R. 5 E., S. B. M., and are the south extension of the Melba group of claims. Owners, J. B. Current, Randcliff Haniman and associates, of San Diego. Elevation 5500 feet.

A number of parallel veins with a general strike of N. 20° W., and a dip to the northeast, occur in the schist. These veins have widths of from 8 to 10 feet, and their outcrops are prominent, being heavily stained with iron oxide.

The workings are on the ridge west of Noble Canyon Creek, and consist of a number of short tunnels and prospect holes. This group of claims is under option to J. M. Schurman and E. E. Northrop of San Diego, who propose to drive a crosscut tunnel to intersect the veins. Two men are employed.

Free Coinage Mine comprises two claims known as Free Coinage No. 1 and No. 2, in Sec. 12, T. 15 S., R. 4 E., S. B. M., in the Deer Park mining district, about eight miles east of Descanso. These claims are on the west slope of the Laguna range of mountains, near the headwaters of Indian Creek. Owner, Edward Quayle, of San Diego.

The vein occurs in the granite, and strikes N. 30° W. with a steep

dip to the northeast. Width of vein is 12 to 18 inches.

Development consists of a vertical shaft 96 feet in depth, with a crosscut east to the vein. From the opencut along the outcrop south of the shaft, it is stated that 100 tons of ore milled at Noble Bros. mill, plated \$18 per ton in gold.

Equipment: A 9-h.p. Fairbanks-Morse gas engine hoist,  $4_4^{3}$ " x  $4_4^{3}$ "

Clayton air compressor, and pump. Idle.

Gold Crown Group of claims comprises five claims located in Secs. 1 and 12, T. 14 S., R. 3 E., S. B. M., in the Boulder Creek mining district, two miles southeast of Anahuac Ranch and 12 miles south of Julian. Owners, R. D. and B. F. Moore, of Julian.

The workings are on the ridge north of Boulder Creek. Here a tunnel has been run 70 feet east to cut a quartzite dike that strikes north. The dike has a width of 12 feet, and is mineralized with pyrite, marcasite, and arsenopyrite, with values in gold of \$2 per ton. The formation is granite. Prospect.

Gold Standard and North Star Mines are situated in the Deer Park mining district, in Sec. 12, T. 15 S., R. 4 E., six miles northeast of Descanso. Elevation 5200 feet. The Gold Standard group comprises six claims; the North Star group has four claims. Owner, J. F. Gage,

of San Diego.

Two parallel veins of quartz occur in the granite on the Gold Standard group. These veins have a general northerly course, and dip 45° W. The east vein has an average width of 4 feet. The North Star vein dips 35° W. and varies in width from 4 to 8 inches. The principal development work has been confined to the North Star vein and the east vein on the Gold Standard claims. The quartz contains free gold associated with pyrite and marcasite. Development on the Gold Standard group consists of two tunnels, the upper tunnel being driven 150 feet north on the vein; the other tunnel 50 feet below is driven north 190 feet. On the North Star vein an incline shaft has been sunk to a depth of 50 feet, and a crosscut tunnel has been driven 190 feet east to cut this vein.

Mine equipment consists of  $4\frac{1}{2}$ " x  $4\frac{1}{2}$ " Rix compressor, air drills, ore

cars, and a blacksmith shop.

Mill: Twenty-ton ore bin, 20-ton ball mill, amalgamation plates and Cottrell concentrator driven by a 20-h.p. White gas engine. Idle.

Golden Chariot Mine is located in Sec. 14, T. 13 S., R. 4 E., four miles southeast of Banner, in the Julian mining district. Claims: Golden Chariot (patented), Golden Chariot North (patent applied for), Mascot, Ida Claire, and Gold Reef. Elevation 3500 feet. Miss Adelaide Elliot, of San Francisco, owns the Chariot and Chariot North; the other claims are held by location by the operating company. Under lease and bond to the Golden Chariot Mining Corporation, 410–412 Mercantile Bank Building, Berkeley, California; C. A. Ferrin, president; P. Young, secretary.

The property was discovered in 1871; worked from 1871 to 1886 producing \$700,000; worked from 1913 to 1914 by the Chariot Mining and Milling Company, of San Francisco. The present company commenced operations in March, 1923, and development work on the

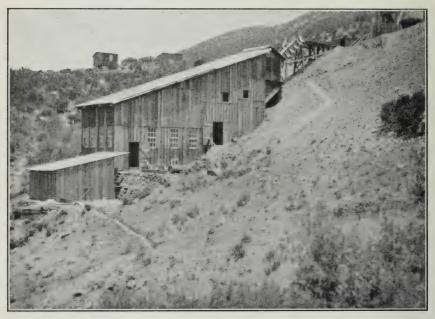
property has been active to date.

The Chariot vein occurs on a contact of mica-schist and gneissoid granite, the former being the footwall and the latter the hanging

wall. The vein is from 2 to 4 feet wide, strikes N. 20° W., and dips 65° NE. The vein is faulted east by a series of step faults. The ore occurs in lenses of quartz on the contact; ore shoots so far developed are short. The quartz is free milling, containing a small percentage of

pyrite and tellurium.

Developments: Three shafts have been sunk on the vein; No. 1 shaft is 200 feet deep, No. 2 is 300 feet, and No. 3 is 250 feet deep. No. 1 shaft, the main working shaft, has been sunk on an incline of 65° and is on the vein to the 100-foot level. At this point the contact flattens to 45°. From the 100-foot level to the 185-foot level the shaft is in the footwall. On the 100-foot level the vein was drifted on south 200 feet. On the 185-foot level a drift was driven 150 feet south from the shaft in the slate footwall; then a crosscut 100 feet east to the contact; then run 130 feet south, connecting with No. 2 (Whitney) shaft, and con-



Five-Stamp Mill, at Golden Chariot Mine, Julian District, San Diego County.

tinuing south 150 feet in ore from the No. 2 shaft to the face of the drift. On the 250-foot level from the Whitney shaft a drift has been driven south 220 feet, and north 60 feet. The No. 3 shaft was sunk to a depth of 250 feet and 125 feet on the vein, the remaining distance in the footwall, then a crosscut was driven east 60 feet to the contact. The ore shoot developed on the 250-foot level is about 200 feet long, has an average width of 4 feet, and is said to have an average value of \$30 per ton in gold. The most productive ore shoot in the mine was from No. 2 shaft. The lens of ore worked out is said to have been about 65 feet in length by 185 feet deep, and 4 feet in width.

Mine equipment: Fifteen-horsepower Foos gas engine hoist (14" x 12") (9" x 12") Imperial Type, Ingersoll-Rand compressor driven by

75-h.p. Holt gas engine, Ingersoll-Rand drill sharpener, blacksmith

shop, and dwellings.

Mill: Blake crusher, Challenge ore feeder, five 850-lb. stamps, amalgamation plates, Wilfley concentrator. Slimes from this concentrator pass over 3 sand tables, each being 12 feet long by 5 feet wide. The mill is driven by 40-h.p. Western gas engine. A 10-kilowatt generator furnishes lights for the mine and mill, and also operates the 3-h.p. motor which runs a 5-inch Bulldose Meyers pump to lift water from the canyon to the tank above the mill. The company is planning to install five more stamps. Fifteen men are employed.

Bibl: State Mineralogist's Reports, VI, p. 86; IX, p. 147; XIII, p. 337; XIV, p. 658; XX, p. 372.

Good Luck Mine comprises one claim located in the Deer Park mining district in Sec. 31, T. 14 S., R. 5 E., S. B. M., about eight miles northeast of Descanso.

The workings are on a ridge east of Deer Park. A vein of quartz four feet wide occurs in the schist. Its strike is N. 30° E., with a dip 50° SE. An incline shaft has been sunk on the vein to a depth of 50 feet. Two men are employed. Owners, Chas. M. Walker, and W. A. Wolff, of Guatay.

Granite Mountain Mine is located on the southwest slope of Granite Mountain at an elevation of 4100 feet. It comprises seven claims in Secs. 15, 16, 21, and 22, T. 13 S., R. 5 E., S. B. M., and is about 10 miles southeast of Julian. Owner, Gus Redman, Julian. Under lease to the Imperial Mining Company; Bryant Howard, president, San Diego.

The formation is mica schist, and the gold values are in the quartz veins. The principal development work is on a vein which has a northerly course, and which dips  $60^{\circ}$  W. It has a width of six inches to two feet. A tunnel has been driven north on this vein for 60 feet. About 50 feet above this tunnel, another tunnel has been driven north on the vein 200 feet. Near the top of the ridge is a quartz vein about 8 feet wide, which has a strike of N.  $60^{\circ}$  W., with a dip of  $45^{\circ}$  NE. Another large quartz vein with a width of 10 feet runs about 200 feet south of the mill, and strikes N.  $30^{\circ}$  W., dipping  $70^{\circ}$  W. The ore from the upper tunnel is dumped into an incline shoot to a small bin at the mill.

Mill: A small Universal crusher, centripact pulverizer, and cyanide tanks. Mill is driven by a 4-cylinder Studebaker motor. Water is secured from Potters Springs 3½ miles west of Granite Mountain. Four men are employed.

Bibl: State Mineralogist's Report, XIV, p. 660.

High Peak Mine comprises four claims known as High Peak, Rosalyn, South High Peak, and Roosevelt, located in Secs. 31 and 32, T. 12 S., R. 4 E., S. B. M., in the Julian Mining district, one-fourth mile east of Julian. Owners, L. A. Smith and Joseph Marks, of Julian. Elevation 4400 feet.

Two parallel veins occur in the schist and strike northwest, dipping 70° NE. These veins vary in width from 1½ to 4 feet.

Developments consist of a shaft 330 feet deep and a tunnel 375 feet in length driven on the vein. Present development work is confined to the tunnel. This mine is worked in a small way.

Bibl: State Mineralogist's Report, X, p. 542; XII, p. 241; XIII, p. 339; XIV, pp. 656, 659.



Shaft and Hoist at Last Chance Mine, Boulder Creek District, San Diego County

Kentuck S. Mine is one-half mile northwest of Banner, at an elevation of 3400 feet. Holdings comprise two claims, the Kentuck S. and Cincinnati Belle in Sec. 3, T. 13 S., R. 4 E., S. B. M. Two parallel veins occur in the schist, the strike being N. 30° W., and the dip 70° NE.

The old workings have been cleaned out and retimbered. The underground workings on the Kentuck S. claim consist of a crosscut tunnel

driven southwest 350 feet. This tunnel intersects a 3-compartment shaft which was sunk to a depth of 100 feet, about 100 feet southwest of the portal. On the Cincinnati Belle claim is a vertical shaft 230 feet deep; also a tunnel driven southwest 200 feet. Two men are employed. Owner, C. A. Shindler, 340 Sixth Street, San Diego.

Last Chance Mine. This property comprises five claims in Sec. 4, T. 14 S., R. 3 E., S. B. M., in the Boulder Creek mining district, on the west slope of the Cuyamaca range of mountains, 12 miles southwest of Julian. Elevation 3000 feet. Owners, International Gold Mines Company; L. E. Meyer, president; F. C. Clark, secretary. Offices,

858 Seventh Street, San Diego.

The country rock is granite. The vein which strikes N. 20° W. has a vertical dip, and is evidently a fault fissure in the granite. The width of the vein varies from 12 inches to 4 feet. A 2-compartment shaft has been sunk on the vein 75 feet. At the bottom of the shaft the vein has a width of 4 feet. The ore shoot which outcropped north of the shaft was underhand stoped to a depth of 25 feet. Twenty tons of ore milled from these workings is stated to have plated \$18 per ton in gold.

The quartz shows some free gold associated with pyrite and marcasite. A number of parallel veins on the property have been pros-

pected by shafts and opencuts.

Equipment consists of a  $4\frac{1}{2}$ -h.p. Fairbanks-Morse gas engine,  $8'' \times 8''$  Duplex compressor driven by a 15-h.p. Samson gas engine, blacksmith shop, cars, and air drills. Two men are employed.

Lookout Group of claims consists of six claims located on Mineral Hill in Sec. 10, T. 14 S., R. 3 E., S. B. M., in the Boulder Creek mining district, 14 miles southwest of Julian. This prospect was located by George H. Moyer, William Acheson and associates, of San Diego.

The country rock is mica schist. A series of parallel veins strike north and vary in width from 12 inches to 2 feet. Developments consist of opencuts, shallow shafts, and short tunnels. Two men are

employed.

Madden Group of mines comprises five claims: Madden, Antelope, Curry, Gopher, and Madden Millsite, located in Secs. 3 and 4, T. 13 S., R. 4 E., S. B. M., one mile northwest of Banner in the Julian mining district. Owner, C. W. Curry, of Julian. Elevation 3500 feet.

The main workings are confined to the Antelope and Madden claims. On the Antelope claim is a crosscut tunnel driven southwest 550 feet. The vein cut in this tunnel is 12 to 18 inches wide, with a northwest strike, and has a dip of 70° SW. About 300 feet of drifts are on the vein

On the Madden claim the workings consist of an incline shaft on the vein to a depth of 100 feet, and a drift north 60 feet. Two veins 12 inches in width occur in the schist. They strike northwest and dip 70° SW. The original shaft, now caved, was 200 feet deep, and is said to have 500 feet of drifts. Two men are employed on development work.

Margaret and Lucky Baldwin Claims are two patented claims in Sec. 31, T. 14 S., R. 5 E., S. B. M., in the Deer Park mining district, 9 miles northwest of Descanso. Owner, James S. Burns, Guatay.

Four parallel veins with widths varying from 12 inches to 2 feet occur in the granite. They have a general northerly strike, and dip 50° E. A shaft 80 feet deep has been sunk on the Margaret claim. The quartz is mineralized with pyrite, marcasite, and arsenopyrite.

Melba Group of mines is on the west slope of the Laguna range of mountains, about 10 miles east of Descanso. The claims are known as the Martha, Elizabeth, Rose, Florence, Grace, and Melba. They are located in Secs. 4 and 9, T. 15 S., R. 5 E., S. B. M., east of the Frances group of claims, and 1½ miles north of the Noble mines. Owners, J. B. Current and Randcliff Haniman, of San Diego.

The vein system consists of five parallel veins that form bold outcrops in a belt of mica schist. This schist belt is a mile wide and extends south several miles between a granite formation. The veins strike N. 30° W., and dip steeply to the northeast. Width varies from 4 to 12 feet. The principal veins upon which the development work has been done, are known as the Frances, Rose, Melba, and Elizabeth. Samples taken from the different workings along the outcrops of veins

are stated to carry values of from \$6 to \$14 per ton in gold.

The main development work has been confined to the Rose and Elizabeth claims, the work on the other claims being shallow prospect shafts and opencuts made along the outcrops where the quartz pans well in free gold. The workings on the Rose claim consists of a tunnel driven north 80 feet; at 50 feet from portal there is a raise 40 feet to the surface. About 150 feet north of these workings is an opencut and short incline on the vein. The quartz is iron-stained, oxidized with occasional bunches of sulphides in the form of pyrite and marcasite. The Elizabeth vein lies approximately 600 feet west of the Rose vein. It is developed by a shaft 50 feet deep, with a drift north on the vein 70 feet and south 27 feet. A crosscut has been driven 268 feet toward the shaft; approximately 60 feet additional will have to be driven to intersect the vein. Six men are employed on development work.

Melrose Group comprises the Empire, Homestake, Stanley, and North Star claims, located in the Julian mining district, near the town of Julian. Robert Melrose of Julian, and Quayle Brothers, of San Diego.

The principal development work has been confined to the Home-stake and North Star claims. Elevation 3200 feet.

Homestake: Formerly the Wilcox Mine. Two veins with widths varying from 6 to 18 inches, striking northwest and dipping to the southwest occur in the schist. Developments consist of a tunnel 600 feet, and an opencut 75 feet.

North Star: It is  $1\frac{1}{2}$  miles southeast of Banner. Two veins 3 feet wide occur in the mica schist. They strike northwest and dip northeast. Developments consist of a shaft 50 feet deep, with drifts 70 feet on one vein. On the other vein is a shaft 115 feet deep.

Bibl: State Mineralogist's Reports: (re Homestake), XII, p. 243; XIII, p. 345. (re North Star), XIII, p. 342.

Montezuma Mine is located in the Rice or Montezuma district, about 12 miles north of Banner, and 6 miles east of Warner, on the slope of San Ysidro Mountain. The formations are metamorphic consisting of

mica schist, gneiss, quartzite, and limestone, and are adjacent to a large granite area. The veins strike N. 65° E., dip 70° NW., and are well-defined fissures that cut the rocks both in strike and dip. This group of claims is owned by the Montezuma Gold Mining Company, of San Diego, which did considerable development on the property. At present idle.

Noble Mines are on the west slope of the Laguna Range of mountains, in what is known as the Laguna or Pine Valley district, about nine miles east of Descanso. The holdings comprise 18 claims located in Secs. 7, 8, and 17, T 15 S., R. 5 E., S. B. M. Elevation 4200 to 5000 feet. Owners, John and Thomas Noble, of Descanso. The property was discovered in 1888 by John Noble, and has been operated off and on from that date to 1914.



Shaft and Hoist at Spring Mine, Noble Mines, Laguna District, San Diego County.

The claims that have the most extensive development are known as the Eureka, Treasury, Bay View, Spring, South End, Oxide, Millsite, and Telluride.

A series of parallel veins occur in a narrow belt of mica schist that strikes northwest and is about one mile wide. The veins that have been exploited occur on the ridges that lie east and west of Noble Canyon. The most productive of these have been the Bay View-Eureka and Treasury veins.

The quartz mined from these claims was hand-sorted, and packed on burros to the mill in Noble Canyon, 11 miles by road. It is stated that the ore milled \$50 per ton. The ore extracted from the different claims on the property has paid for all development, and the owners

have realized considerable profit from their operations.

Bay View-Eureka vein strikes N. 35° W. and dips 60° E. and is located 300 feet east of the west contact of schist and granite. It has a width of three feet. The workings on the Bay View claim consist of a tunnel driven southeast 50 feet on the vein, and an opencut 75 feet in length above the tunnel. The ore mined from these workings is said to have milled \$10 per ton in gold. On the Eureka claim a cross vein 6 to 12 inches wide strikes N. 50° E. with a vertical dip, and cuts the Bay View-Eureka vein.

At the intersection of these two veins is an opencut 40 feet in length, and a shaft 120 feet sunk on the intersection of the two veins. The ore milled from these workings is reported to have averaged \$30 per

ton. The quartz shows free gold, galena, and tellurium.

Other workings on the Eureka claim consist of two tunnels; one 150 feet long, 60 feet below the surface, and the other 350 feet long,



Five-Stamp Mill, Noble Mines, Laguna District, San Diego County.

150 feet below the above-mentioned tunnel. A shaft at the mouth of tunnel No. 1 is 100 feet deep, with drifts on the 50 and 100-foot levels,

and opencuts on the lode 200 feet in length.

On the Treasury claim, a tunnel has been driven southeast 330 feet on the vein which is 18 inches to 2 feet wide. This vein is 300 feet west of the Eureka vein, and occurs on the contact of schist and granite. It strikes northwest and dips 70° NE. The hanging wall is composed of schist with granite as a footwall. Near the face of the tunnel is a raise 125 feet to the surface. The ore shoot developed in this tunnel is 125 feet long, and stoped to the surface. About 200 feet below this tunnel a crosscut tunnel was driven 225 feet northeast to cut the Treasury vein.

On the top of the ridge on the Mt. Lion claim two shafts have been sunk on a vein which strikes N. 30° W. and dips 75° NE. Width of

the vein is six feet with a 12-inch streak of pay ore on the footwall.

Shafts are 100 feet deep.

On the Spring claims is a shaft 200 feet deep, with drifts on the 60-foot level, 80 feet; on the 100-foot level, 150 feet; on the 200-foot level, 50 feet. The shaft is vertical for a distance of 80 feet, then on the vein for 120 feet.

Considerable development work was done on the Oxide, First and Last Chance claims, which are located near the east contact of schist with the granite area. The workings are caved. The veins on these claims are 6 to 8 feet wide. The ore mined from the Oxide Mine is reported to have milled \$10 per ton in gold.

Mine equipment consists of 25-h.p. West Coast gas engine hoist

located at the shaft on the Spring mine.

The mill is located on Noble Creek on the Millsite claim and consists of grizzly, ore bin, Blake rock crusher, Challenge ore feeder, five 650-lb. stamps, 7-foot Lane mill, 10-foot amalgamating plates, and 2

Frue vanners. Mill is driven by a 22-h.p. Foos gas engine.

Water supply is abundant, being secured from near the head of Noble Canyon, the flume line being 3500 feet in length, giving a head of 200 feet at the plant. Seven hundred feet of 8-inch pipe connect the flume with a Knight 40-inch water wheel. Assay office, barn, and living quarters. The mines are operated at intervals by the owners.

Bibl: State Mineralogist's Report, IX, p. 141; X, p. 544; XI, p. 382; XII, p. 238; XIII, p. 342; XIV, pp. 663-664.

Oriflamme Mine is located six miles southeast of Banner and four miles due east of the Stonewall Mine, in Sec. 1, T. 14 S., R. 4 E., and Sec. 6, T. 14 S., R. 5 E., S. B. M., on the eastern slope of the Cuyamaca range of mountains. Elevation 4500 feet. Holdings comprise 128 acres. Owners, L. S. Spaulding and Herman Ritter, Jr., of San Diego.

Two veins occur in a belt of mica schist, which is flanked on the east by granite and on the west by a broad belt of argillaceous slates. The belt of schist strikes northwest and the dip of the schist is 75° to the northeast. Total length of the underground workings is about 1000 feet. The veins have a width of four feet. The vein quartz is mineralized with pyrite and is reported to carry tellurides. The mine has not been operated since 1905, but the owners are planning to re-open the mine, and have made cyanide tests on the ore, reporting a good extraction.

Bibl: State Mineralogist's Reports, VI, p. 89; XIII, p. 342; XIV, p. 660.

Owens Mine is one-half mile north of Julian, and comprises two patented claims known as Old Owens and New Owens; also the Janet claim (unpatented), which is the west extension of the two Owens claims, in Sec. 31, T. 12 S., R. 4 E., S. B. M. Elevation 4200 feet. Owner Howard Williams, of Julian. Under lease and bond to the Williams Gold Mining Company; R. F. McClellan, president; Judge D. F. Ballard, secretary; E. W. Sawtelle, treasurer; Thomas H. Teal, general manager, Los Angeles.

The property is developed by a vertical shaft 350 feet deep. It is reported that two separate veins, known as the Owens and Red Ledge, were worked through this shaft. The Red Ledge vein lies

a little to the northeast of the Owens, and near the surface of the ground they are 20 feet apart. The strike is northwest and dip 80° to the northeast. The Red Ledge vein was worked to the 200-foot level, but the Owens vein was worked down to the 300-foot level for a distance of probably 400 feet along its strike, most of this distance being southeasterly from the shaft. Both veins are said to have an average width of three feet, the maximum width of the Owens vein being 4 feet. The veins, which strike N. 70° W., and dip at a high angle to the northeast, are conformable with the inclosing mica schist. A 10-stamp mill is on the property.

The mine has an estimated production of \$500,000. The present company plans to sink a vertical shaft on the Janet claim to a depth of 400 feet. On this claim a crosscut tunnel has been driven southwest 125 feet to the Owens vein, and the vein drifted on both northwest and southeast. The vein exposed is 4 to 8 feet in width. Six

men are employed.

Ranchita Mine is 1½ miles southeast of Banner at an elevation of 3300 feet. It comprises 160 acres of patented agricultural land, and the Elevada claim, also patented, all in Secs. 11 and 12, T. 13 S.,

R. 4 E., S. B. M. Owner, C. J. Couts, Vista, California.

The formation is mica schist, striking northwest and dipping 70° NE. The Ranchita vein is reported to have been made up of a series of nearly parallel quartz lenses which cut the strike of the schistose rock at an angle of 20°. These lenses seem to terminate on reaching a fault plane striking east and west. These quartz bodies were from 12 inches to 3 feet thick, and are found 4 to 5 feet apart, for some distance along the fissure. The vein was developed by a shaft 145 feet deep, from which several levels were run, and a considerable amount of stoping. On the Elevada claim the vein has a northerly strike, and dips 45° W. The Elevada vein will probably intersect the Ranchita vein about 500 feet south of the Ranchita shaft. The vein is 2 to 8 feet wide.

Development consists of a crosscut tunnel driven west 200 feet to the vein, with a drift 500 feet south on the vein. On the ridge above this tunnel an incline shaft was sunk to a depth of 160 feet. Levels were driven at 50 and 100 feet. Ore is stoped to the surface. This property is reported to have produced some very rich specimen ore. The reported production of the mine is \$150,000.

Mine equipment consists of cars and tools. A 10-stamp mill is on the

property. Under option to W. H. Knowles, of San Diego.

Ready Relief and North Hubbard Mines are situated in Secs. 10 and 11, T. 13 S., R. 4 E., S. B. M., three miles southeast of Julian in the Julian mining district. Elevation 2900 feet. The Ready Relief group, comprising 10 claims is owned by Annie Laurie and Mary A. Baily of Julian; the North Hubbard claim is owned by G. W. Hazzard of San Diego. Total area 225 acres. Under lease and bond to Lone Pine Mining and Milling Company, 427 Spreckels Building, San Diego. S. C. Blackman, president; Anna M. Pederson, secretary; D. B. Boyden, superintendent.

This group of mines has been one of the most productive in the Julian district. The present company started operations on the property during the latter part of 1923. The strike of the schist belt in

which the North Hubbard-Ready Relief vein occurs is northwest and varies but little from this over a wide area. The country rock is a dark gray schist, having a dip of 80° E. The vein is in the form of quartz which has been subjected to stress, producing a folding of the vein. In places, several of these folds of the vein lie side by side. Where this condition occurs the pay shoot is large. The thickness of the individual rolls varies from a few inches to six feet, and where these folds parallel each other, a width of 12 feet was noted. The vein is in the form of a 'stringer lead' with occasional wide lenses of quartz, and strikes N. 60° W., dipping 70° NE. Width varies from 2 to 6 feet. The quartz is banded, and shows free gold, some pyrite and arsenopyrite.

Since the property was visited in October, 1924, development work has been confined to the North Hubbard claim, and the vein has been drifted on 500 feet NW. from the main crosscut toward the Ready Relief mine workings. At this distance a streak of high-grade quartz



50-Ton Mill at North Hubbard Mine, Julian District, San Diego County.

8 to 12 inches wide was cut on the hanging wall. This is stated to assay \$400 per ton. The average value of the ore mined is about \$15 per ton in gold.

North Hubbard workings: Crosscut tunnel driven southwest 200 feet to the vein, with drifts 500 feet northwest, and 200 feet southeast

on the vein.

Mine equipment consists of an Ingersoll-Rand compressor, Ingersoll-Rand drill sharpener, air drills, cars, blacksmith and machine shop, and

dwellings.

Mill equipment: On North Hubbard is a 5-stamp mill. On the Ready Relief is a 50-ton amalgamation and concentrating plant. For full description of property see State Mineralogist's Report XX, p. 373. Six men employed.

Bibl: State Mineralogist's Reports, VI, pp. 87–88, VIII, pp. 513–514; IX, p. 147; X, p. 543; XI, pp. 378–380; XIII, p. 344; XIV, p. 657; XX, p. 373.

Schley Group of claims is located in the Deer Park district, 10 miles northeast of Descanso. It comprises five claims located in Secs. 1 and 12, T. 15 S., R. 4 E., S. B. M., on the ridge east of Indian Creek. A vein of quartz four feet wide, having a strike of N. 30° W., and a dip 80° E., occurs in the granite.

Developments consist of a number of short tunnels and shallow shafts along the outcrop of the vein on the different claims. The average value of the ore is said to be about \$4 per ton in gold. The quartz is oxidized being iron-stained, and shows occasional bunches of pyrite and arsenopyrite. C. M. Walker of Descanso, owner.

Silver King Mine comprises five claims located in Secs. 2 and 3, T. 14 S., R. 3 E., S. B. M., in the Boulder Creek mining district, on the ridge north of Kelly Creek, 14 miles southwest of Julian. Elevation 2500 feet. Owners, George H. Moyer, and T. E. Merritt, of Julian.

A vein four feet wide with a northwest strike and a dip 45° NE.

occurs in a belt of mica schist that has a width of 600 feet.

Developments consist of three tunnels and a shaft. The lower tunnel has been driven as a crosscut 130 feet to intersect the vein, but lacks 70 feet. At a height of about 150 feet above this tunnel, a crosscut has been driven 110 feet to the vein with 70 feet of drifts on the vein. Also an intermediate tunnel has been driven 50 feet on the vein, and a shaft 50 feet deep located one-fourth mile west of these workings. The quartz contains galena with gold and silver values. Two men are employed on assessment work.

Stonewall Mine is situated on the south bank of the Cuyamaca Reservoir, 10 miles south of Julian, on the Cuyamaca Grant. The grant, including the mine, was purchased in September, 1923, by R. M. Dyar, of Beverly Hills, California, and A. B. Smith, of Cleveland, Ohio.

The country rock is banded mica schist. The vein strikes N. 35° W., and dips 65° W. The mine was located about 1870 and was worked for about five years prior to 1891 by ex-Governor Waterman of California. It was the most productive in San Diego County, the total production being over \$2,000,000. The great production of the bonanza days came from a shoot some 300 feet long, which was worked to a depth of 500 feet. The vein in places was 20 feet wide. The shaft had a depth of 600 feet. The mine was closed down in 1893 and has been idle since that date.

Bibl: State Mineralogist's Reports, VI, pt. 1, pp. 89–90; VIII, pp. 515–516; IX, p. 143; X, p. 540; XI, p. 382; XII, p. 243; XIII, p. 345; XIV, pp. 660–661.

Telluride Group of claims comprises two claims known as Blue Jay and Telluride, in Sec. 31, T. 14 S., R. 5 E., S. B. M., Deer Park mining district, 10 miles northeast of Descanso. Owner, Mrs. James S. Burns, Guatay. These claims adjoin the Gold Standard claims on the north. Several parallel narrow veins of quartz occur in a belt of mica schist that has a general northwest strike. The veins are from 2 to 12 inches wide, strike northwest, and dip 70° SW. The quartz is blue ribbon quartz, mineralized with galena and pyrite. The ore is reported to have values of from \$15 to \$30 per ton in gold.

Developments consist of a crosscut tunnel driven N. 40° E., 100 feet. At 30 feet from the portal a narrow vein 10 inches in width is cut, and a winze has been sunk on the vein to a depth of 30 feet. One man is employed.

Tom Scott Mine comprises one claim located in Sec. 31, T. 12 S., R. 4 E., S. B. M., in the Julian mining district, one-fourth mile north

of Julian. Owner, Chas. W. Curry, of Julian.

Two parallel veins 18 inches wide occur in the mica schist, and strike northwest and dip northeast. Workings consist of a shaft 225 feet deep and a tunnel 300 feet in length. The shaft has been cleaned out and retimbered to a depth of 126 feet.

Van Wert Mine comprises one claim located in Sec. 31, T. 12 S., R. 4 E., S. B. M., in the Julian mining district, one-half mile northwest of Julian. Owner, Joseph Marks, of Julian. This is one of the first

locations made in the Julian district, being located in 1869.

The workings comprise two tunnels, the one furthest north being a crosscut driven N. 40° E., 200 feet. The vein was intersected at about 150 feet, and has been drifted on for a distance of about 150 feet. The vein 18 inches to 2 feet wide is in mica schist, strikes N. 35° W., and dips 60° NE. It has been stoped to the surface. On the southeast end of the claim is a crosscut tunnel 200 feet in length, now caved. Idle.

Victoria Group comprises three claims located in Sec. 9, T. 15 S., R. 5 E., S. B. M., on the west slope of the Laguna Mountains, 10 miles east of Descanso. These claims are located west of the Melba group, on veins that are parallel to the Elizabeth and Rose veins. The formation is mica schist. The workings are superficial, comprising opencuts and prospect shafts along the cutcrops of veins that strike N. 30° W. Width of veins 4 to 6 feet. Owners, Thomas Blair and James McKie, of San Diego.

Willhite Group comprises two claims located in Sec. 17, T. 15 S., R. 5 E., S. B. M., on the west slope of the Laguna Mountains, nine miles east of Descanso. Owner, O. D. Willhite, of El Cajon. The claims

adjoin the Noble Mines on the southeast.

The formation is a mica schist. A number of parallel veins of quartz occur in the schist near the west contact of the granite. These veins strike northwest and dip 70° NE., and have widths varying from 6 to 12 feet. A number of shallow shafts, the deepest 100 feet, have been sunk on the different veins. The quartz is heavily mineralized with pyrite and arsenopyrite, with gold and silver values. Near the contact of the schist and granite is a wide outcrop of metamorphic rock and epidote mineralized with sphalerite (zincblende) said to carry silver values.

#### IRON.

A few deposits of iron in the form of magnetite occur near Campo, Flinn Springs, and Lakeside. Oxidized cappings of veins, which through the oxidation of sulphide ores have left a formation of gossan on the surface, also occur near Julian. The outcrop in Sec. 15, south of Julian is the gossan of the Friday vein which carries copper and nickel. An exposure of gossan also occurs at the corner of Secs. 34 and 35, T. 13 S., R. 2 E., and Secs. 2 and 3, T. 14 S., R. 2 E., S. B. M.

The deposits have been located but outside of assessment work on the claims no development has been attempted.

Iron Master Group of Claims is located six miles east of Lakeside in T. 15 S., R. 1 E., S. B. M. Eight claims have been located by B. F. Stanwood and associates of San Diego. The iron occurs as magnetite in the granite. Not enough development work has been done to determine the extent of the deposit. Two feet of ore is exposed in one prospect hole of shallow depth.

Lakeview Group of Claims is located in T. 15 S., R. 1 E., S. B. M., on the south slope of El Cajon Mountain, three miles northeast of Lakeside. Elevation 2000 feet. Owners, B. F. Stanwood and associates, of San Diego.

The ore occurs as hematite and magnetite. Analysis of ore is stated to show 70% iron, with low phosphorous and sulphur content.

Campo Iron Deposit is located two miles west of Campo, north of the highway, in Sec. 22, T. 18 S., R. 4 E., S. B. M. The ore is magnetite. From a shaft sunk in decomposed granite a large number of pieces of magnetite have been extracted, but no vein has been found in place.

## LEAD.

This metal has been reported in small quantities at several points in the county, the chief occurence being  $2\frac{1}{2}$  miles north of Valley Center, in the NW $\frac{1}{4}$  of Sec. 1, T. 11 S., R. 2 W., S. B. M. Here a vein of quartz containing zincblende and galena, with silver values occurs in the mica schist. The vein is three feet wide, strikes northwest and dips  $60^{\circ}$  SW. The workings consist of a 45-foot shaft and a tunnel 100 feet in length. Galena also occurs in some of the quartz veins on the west slope of Laguna Mountains, and on the Telluride claim in the Deer Park district.

## MANGANESE.

A mile and a half northwest of Jacumba are surface indications of manganese in the form of superficial deposits of the oxide. Some manganese-stained outcrops of quartz occur in the vicinity of Campo. It does not appear as if these deposits will be of commercial importance due to the high silica content.

Jacumba Manganese Group of claims is located one mile northwest of Jacumba in Secs. 5 and 6, T. 18 S., R. 8 E., S. B. M. Elevation 2900 feet. Eight claims have been located by B. F. Stanwood and associates of San Diego. A number of silicified outcrops with a general northwest strike occur in the granite. At a number of points these outcrops are heavily mineralized with manganese oxides. Analysis of ore extracted from different prospect holes is reported as: Manganese, 7% to 22%; Iron, 14%; Silica, 16% to 25%.

#### MOLYBDENUM.

Molybdenite has been found at several points in the county. It occurs disseminated in flakes and small masses in a micaless granite or aplite which appears to be in dikes in the surrounding biotite granite. The principal deposits are situated northwest of Ramona; also occurrences are noted at several points between Campo and Julian.

During 1916–1917 much activity was shown in the development of these deposits on account of the market value of the metal caused by the World War. At present writing none of the deposits are being worked.

Molybdenite ( $MoS_2$ ), molybdenum sulphide, contains 41% sulphur and 59% molybdenum. The principal value of molybdenum lies in its steel hardening qualities. Therefore its principal markets are in the eastern steel centers. Molybdenum steel, containing from 6% to 10% of the metal is used for highspeed cutting tools, propeller shafts, rifle barrels etc. It is used with tungsten in electric lamp filaments, and in electric furnaces. The market quotation at San Francisco in June, 1918, was \$1.25 per pound for 90%  $MoS_2$ . Quotation July 4, 1925, was 85%  $MoS_2$ ,  $80\phi$  per lb.

Campo Molybdenum Deposit is on the ridge west of Campo in Sec. 9, T. 18 S., R. 5 E., S. B. M. Elevation 2650 feet. The molybdenite occurs disseminated in flakes and small masses in an aplite dike in biotite granite.

Ramona Molybdenum Deposits are the most important occurrences of molybdenite in the county, and considerable development was done on the various surface outcrops which are located from 5 to 8 miles west and southwest of Ramona, on a ridge south of San Pasqual Valley. The different deposits in this area were described in State Mineralogist's Report XVII, pp. 379–380, so only brief mention of these will be made in this report.

Bour Molybdenum Deposit is located six miles west of Ramona in Secs. 3 and 10, T. 13 S., R. 1 W., S. B. M. Owner, Mrs. E. M. Bour, 118 Harrison Avenue, San Diego. This is the most important deposit in the county, and upon which the most development work has been done.

Molybdenite occurs in flakes and small masses in an aplite dike 30 to 200 feet wide and 1500 feet in length. Two well-defined shoots of ore have been developed by opencuts about 100 feet in length, and 15 feet deep on the crest of the hill. The ore extracted from these workings is said to have carried an average of 0.5% to 1% molybdenum sulphide.

Developments consist of a crosscut tunnel 240 feet in length, driven to cut the dike. The molybdenite is very unevenly distributed throughout the rock, the greater part of the aplite dike being barren, and the mineral is only concentrated at various points along this dike. Idle.

Judson Ranch Deposit is situated five miles west of Ramona in Secs. 1 and 12, T. 13 S., R. 1 W., S. B. M., and is one mile west of the Bour Mine. Molybdenite occurs in an aplite dike in surrounding granite, and strikes east with a dip south. The dike has a width of 50 to 100 feet. The molybdenite occurs in a zone 20 feet wide, and is unevenly distributed, the greater part of the rock being barren.

Woolsey Molybdenite Deposit is eight miles southwest of Ramona and one-half mile southeast of Shady Dell Ranch on the highway to San Diego. The molybdenite occurs here in flakes and masses distributed through a biotite granite.

Molybdenite also occurs on the *Harvey Ranch* in Sec. 19, T. 15 S., R. 2 E., S. B. M., 11 miles east of Lakeside, in small flakes in aplite,

and on Mayer's Ranch on the north side of Cottonwood Creek, four miles southeast of Dulzura.

## NICKEL.

Nickel produced in the United States is derived principally as a by-product from the electrolitic refining of copper. The proportion of nickel coming from the domestic copper ores is undetermined but small. The bulk is produced in Canada and comes to the United States in the form of a rich copper-nickel matte from which the refined nickel is produced. More than enough to supply the needs of the United States is imported for refining and the balance is exported. No nickel is produced commercially in California. One of the principal ores is the nickel-bearing iron sulphide, pyrrhotite. It also occurs with copper ores, or combined with arsenic or sulphur or both. It is also the constituent of several cobalt ores, and is obtained as a by-product in the smelting of lead and copper ores. Pyrrhotite (Fe₇S₈), iron sulphide, contains 60.5% Fe and 39.5% S., and is often a valuable ore of nickel, containing from 3 to 5% of this metal. In the Friday Mine near Julian the ore consists mainly of pyrrhotite carrying 4% to 5% nickel.

Friday Mine is located four miles southwest of Julian in the SW¹₄ of Sec. 15, T. 13 S., R. 4 E., S. B. M. Owner, Friday Copper Mining Company; Frank Brown, president, American National Bank Building, San Diego.

On the surface the outcrop of the vein is an iron gossan consisting chiefly of limonite. This iron gossan capping strikes east, has a width of 25 to 50 feet, and can be traced west one-fourth of a mile to the Gibson property on Sec. 16. In the upper workings of the mine, copper sulphides and carbonates with a trace of nickel are present. The ore-body is developed by a vertical shaft which is in gossan for 60 feet. The shaft is vertical for a depth of 130 feet. From the 130-foot level the shaft is sunk on an incline of 70° for a distance of 45 feet. On the 130-foot level an orebody 60 feet long and 20 feet wide was developed. It lies near the contact of gabbro and schist, and in places is inclosed in gabbro. On the 175-foot level only a small lens of ore was encountered. The ore consists mainly of pyrrhotite, but also contains pyrite and an iron-nickel sulphide, and is accompanied by small quantities of calcite and amphibole.

Analysis of ore made by Dearborn Chemical Company, of Chicago,

Illinois, is as follows:

Silica (SiO ₂ )	
Iron (Fe)	38.65%
Nickel (Ni)	4.34%
Cobalt (Co)	2.37%
Arsenic (As)	5.95%
Sulphur (S)	35.49%
Copper (Cu)	Trace

Assay of selected ore said to carry 22% nickel.

The mine was originally developed as a copper property, but the ore encountered in the underground workings shows only a trace of copper. During the early part of 1924 the property was under lease to Allen R. Partridge and associates, of Los Angeles, who installed a

small furnace, but their process of treatment was not successful. After a short time operations were suspended. Idle.

Bibl: State Mineralogist's Reports, XIV, pp. 666-667; XVII, pp. 380-381. U. S. Geol. Survey Bull. 640-D.

Silver occurs in the county associated with copper and gold ores. In addition to the silver-lead ore at Valley Center, silver occurs in quartz veins on the Willhite Group of claims, south of the Noble Mines in the Pine Valley district.

#### TIN.

Two occurrences have been noted in northern San Diego County. Crystals of cassiterite were found there associated with blue tourmaline crystals, amblygonite, and beryl. No commercial quantity has been developed; only small pockets have been taken out. It is reported that placer miners working the gulches on the east slope of Laguna Mountain have found small grains of cassiterite or oxide of tin in the black sand.

## TUNGSTEN.

Tungsten ore in the form of scheelite (calcium tungstate) occurs associated with gold quartz veins in the Deer Park district. The most recent discovery was made on the Gold Standard group of claims. It also occurs in the Aguanga Mountains near Oak Grove Valley in the northern section of the county near the Riverside County line. Here some production has been made from the Oak Grove Tungsten Mine, owned by Bert Simmons and J. Wentworth, of Aguanga.

The metal tungsten is used mainly in the steel industry and in the manufacture of electrical appliances, including the well known tungsten filament lamps. Because of its resistance to corrosion by acids, it is valuable in making certain forms of chemical apparatus. Its employment in tool-steel alloys permits the operation of cutting tools, such as in lathe work, at a speed and temperature at which carbon steel would lose its temper. These are known as 'high speed steels,' and tungsten forms about 20% of such steel tools.

## ZINC.

This metal occurs in small amounts in the county, being associated with lead ore as sphalerite (zincblende) in gold-quartz at the Descanso Mine near Descanso. It is also found associated with lead at Valley Center, and in epidosite on the San Vicente Grant. It also occurs in Deer Park and Laguna districts associated with other sulphide ores.

# NON-METALLIC MINERALS.

The rapid growth of the cities on the Pacific Coast, and especially the city of San Diego, which has increased from a population of 74,500 (1920 census) to an estimated population of 135,000 has caused an increasing demand for both industrial and structural materials. Diego County has a great variety of commercial minerals which are used locally, and a large tonnage of both industrial and structural materials are shipped north to the manufacturing centers along the Pacific Coast. Deposits of granite, marble, and limestone are distributed throughout this county, and transportation and other facilities are gradually being extended so that the growing demand may be met. Crushed rock production is yearly becoming more worthy of consideration due to the strides recently made in the use of concrete, as well as the activity in building good roads. The most important recent developments in feldspar deposits have taken place in the county where large deposits of massive high-grade spar are being opened up. These deposits are unusually free from black mica and other deleterious iron-bearing minerals objectionable in pottery work. The more important of these minerals thus far exploited as shown by the output are clay, feldspar, gems, granite, mineral water, marble, fuller's earth, and silica.

#### CLAY.

San Diego County contains deposits of both pottery clay, and clays suitable for the manufacture of brick and tile. Extensive exposures of Eocene Tertiary clay and shale occur near the coast, and a number of deposits from Carlsbad south to Ladrillo have been developed on a commercial scale. Commercial deposits of fire clay have been developed six miles east of Cardiff. The exposures of clay or shale in the bluffs of Rose Canyon and extending for a distance of some three miles north from Ladrillo Station to Linda Vista have been developed and worked for years by the local brick companies. These deposits are extensive, and will readily supply the increased demand for the manufacture of brick and tile. The deposits are within close proximity to the Atchison, Topeka, & Santa Fe Railroad. A more detailed report on the clay resources is being prepared for the Bureau by Mr. W. F. Dietrich

El Cajon Kaolin Deposit is located on Cajon Mountain, at an elevaof 2500 to 2700 feet, 4½ miles northeast of Lakeside. Owner, American Pottery Company, of Los Angeles. Holdings comprise two claims in T. 14 S., R. 2 E., S. B. M. The clay is an impure white kaolin, containing varying amounts of grit. It has been exposed at various points on the mountain, and appears to occur in a zone that has a general northeast strike.

The deposit is developed by a number of tunnels and shafts, the main working tunnel being driven northwest 75 feet, and is 50 feet below the surface. This tunnel has exposed a stratum of kaolin 50 feet thick, and near the face of this tunnel is six feet of fairly plastic material. The deposit was developed and worked in 1914 and 1916 by the California Clay Products Company with a plant at National City. The material was packed by mules over a trail to a point on the San Diego River, and then hauled by wagon to Lakeside. Due to its inaccessibility, outside of annual assessment work, there has been no work on the deposit since 1916.

Analysis of Selected Sample by Smith-Emery Company.

Silica	49.14%
Tron Oxide	1.44%
Aluminum Oxide	31.26%
Calcium Oxide	
Magnesium Oxide	0.20%
Sodium Oxide	0.51%
Loss by ignition	16.52%

# Brick and Tile Manufacturers.

California Clay Products Company and Mission China Company; Victor Kremer, president; R. B. Keeler, secretary. Offices 315 Western Mutual Life Building, Los Angeles. This company owns a deposit of fire clay located in Sec. 4, T. 13 S., R. 3 W., S. B. M., five miles northeast of Cardiff. The holdings of the California Clay Products Company consist of the Pearl and the Dorothy placer claims comprising 40 acres; the Mission China Company owns two adjoining claims known as the Robert Charles and the Thomas Hewitt, also 40

The clay is a white, semi-plastic fire clay. It does not develop sufficient plasticity to be used alone, and is of value principally for its refractory qualities. A number of test pits and benches have been dug, exposing the clay over a considerable area. Mining is being done on the Pearl claim, where a small opencut has been excavated. The exposed bank of clay is 10 to 12 feet high.

Material from the opencut is trammed to a loading bin, from which it is hauled by trucks to Carlsbad. One carload per week is being shipped. The material goes both to the company's plant at Los Angeles, and to the Vitrified Products Company's plant at San Diego. These companies are controlled by the Victor Kremer Enterprises.

Los Angeles Pressed Brick Company; Howard Frost, president; H. B.

Potter, secretary. Offices, Frost Building, Los Angeles.

This company owns a deposit of fire clay on the same bed as that being worked by the Vitrified Products Company of San Diego, on the east side of a low hill on which the clay occurs. It adjoins the Vitri-

fied Clay Products Company deposit on the southwest.

The clay bank is exposed by an opencut with a 30-foot bank. The clay is a white, semi-plastic material, being more uniform in character than on either of the other two developed properties in the district, but is somewhat sandy in places, and the iron content varies. The clay from the opencut is transported in cars to the loading bin, from which it is hauled by motor truck to Cardiff.

The production is three to four cars per week for part of the year, the annual production being 100 to 150 cars per year. The product is shipped to the Los Angeles plant of the company, and is used in the

manufacture of face brick.

Morris Clay Deposit; H. T. Morris, of Escondido, owner. deposit is located one mile south of Richland Station on the Escondido branch of the Santa Fe Railroad.

The clay occurs in a low hill, and is covered with black adobe soil. The deposit is 15 feet in thickness and underlies several acres of land. It has not been developed, therefor good exposures of fresh clay are lacking.

Morton Clay Deposit; G. H. Morton, Elsinore, owner. This deposit lies three miles east of Farr Siding, on the Santa Fe Railroad, one mile south of Carlsbad. Holdings comprise 30 acres. The clay is said to be a white, plastic, vitrifying clay, slightly iron-stained. The deposit has not been developed to determine its extent nor the quality of the clay.

National Brick Company; William Mulford, president; Edward Harrie, Jr., secretary. Offices and plant are located at 24th Street and National Boulevard, National City. The holdings of the company comprise 13 acres, under lease from S. Christian, of National City. The company is manufacturing common red brick from adobe clay. The clay is hauled by scrapers to a hopper, from which it passes to a set of rolls where the clods are broken up. It is then conveyed over a belt conveyor to a pugmill, from which it passes to a brick press.

The brick is dried in sheds. The dried brick are fired in open oil-fired kilns. The plant is driven by a 50-h.p. electric motor, and has

a capacity of 36,000 brick per day. Fifteen men are employed.

Pacific Clay Products Company; Wm. Lacy, president; W. R. Fawcett, secretary; Robert Linton, general manager. Offices, New Chamber of Commerce Building, Los Angeles.



Pacific Clay Products Company's clay pit near Farr Siding (Carlsbad), San Diego County. Photo by W. F. Dietrich.

The deposit is located three miles east of Farr Siding, on the Santa Fe Railroad. The property was formerly part of the Kelley Ranch,

and comprises 25 acres.

The clay beds are exposed on a low rounded hill. The upper 10 to 15 feet consists mainly of a white, plastic, vitrifying clay that is slightly iron-stained. Underlying the bed of white clay is a bed of mixed yellow and blue plastic clay of undetermined thickness. The clay has been prospected by means of a number of test pits on the property. The mining is done with horse scrapers and plows, and with a wheelscraper drawn by a tractor. A bench has been established for mining the upper bed of white material separately from the yellow and blue. The exposed bank of white clay is 275 feet long. The present production is 20,000 tons per year and is hauled to Farr Siding by trucks.

San Diego Brick and Tile Company; Wm. Roffe, president. This company controls 100 acres of land in Rose Canyon. The material

used is an Eocene clay and Tertiary shale, which is for the most part thin-bedded, moderately hard, and yellowish gray in color. The clay pit and plant are on the west side of the canyon. The clay is scraped into chutes alongside of the Rose Canyon Road, at a point 50 feet vertically above the yard. The clay bank exposed is about 75 feet high, and 300 feet long. Practically no overburden is present. The clay from the chutes is hauled by cars to the dry pan and stiff mud machine. The dry press has a capacity of 20,000 brick per day. The brick are dried partly in the open air and partly under sheds, and are fired in open oil-fired kilns. This company manufactures common brick and hollow building tile. The plant is operated as required to supply local demand.

Union Brick Company; J. C. Rice, secretary, San Diego. The company's plant is located in Rose Canyon, 10 miles north of San Diego. The clay mined is from exposures of Eocene Tertiary clay and shale in the bluffs of Rose Canyon. It is thin-bedded, hard, and yellowish in color, forming a bank 50 feet or more in height. Underlying this material is a bed of plastic clay or shale, blue-gray in color.

The clay is mined by Fordson Tractors and scrapers which dump the material into a chute leading to the brick yard in the bottom of the canyon. The plant is equipped with dry pan and two presses; bricks

are burned in oil-fired field kilns. Fuel oil is used for burning, and

electric power for operating presses.

Vitrified Products Corporation; Victor Kremer, president; George W. Kumer, general manager; John F. Keenan, superintendent. Office, 523 Spreckels Building, San Diego. This company owns clay deposits at Cardiff and Linda Vista.

The Cardiff deposit is located five miles northeast of Cardiff, a station on the Santa Fe Railroad, in Lot 18, Rancho Las Encinitas, and comprises 16.6 acres. The fire clay has been exposed on the east and west sides of a small hill by two openeuts with a bank of 15 to 20 feet. This bed is from 10 to 12 feet thick, and is overlain by a thin layer of soil and yellow, sandy clay. The beds are nearly horizontal. Underlying the fire clay is a bed of soft, loosely consolidated sandstone, containing clay as a filling material. The fire clay is moderately hard and varies in color from a buff to blue-gray and light purple. The production varies according to the demand, one to two cars per week being mined and shipped from a siding one mile south of Cardiff.

The Linda Vista deposit is located on the south side of the santa Fe Railroad, about two miles north of Linda Vista Station, in Sec. 9, T. 15 S., R. 3 W., S. B. M. Holdings consist of 300 acres, most of which is underlain by clay beds. The deposit has been opened up by a clay pit 300 feet in length and 50 feet high, adjacent to the railroad tracks. The material being mined is a clay shale. Interbedded in the shale are beds of siliceous sandstone, about 12 inches thick. These are sorted from the clay wherever possible. The clay is light yellow in color, with iron staining in the bedding planes. The overburden varies from one to three feet in thickness. The total thickness of the clay beds is probably not less than 100 feet. The production is from 200 to 300 tons per week, and is shipped over the Santa Fe Railroad to the company's plant at Old Town, San Diego.

The brick and tile plant has a grinding capacity of 200 tons per day, producing 50,000 common brick and 50,000 hollow tile per day. The hollow tile and building tile are made by mixing 25% of the Cardiff fire clay with 75% of the Linda Vista clay shale. The company is manufacturing hollow building, and wall tile, flue lining, face, building, sewer, vitrified, and fire brick. They also produce electric conduit pipe, and vitrified sewer pipe. A full description of the plant is contained in the State Mineralogist's Report XX, pp. 369–370.

## FELDSPAR.

San Diego County contains large deposits of massive, high-grade feldspar, which is unusually free from black mica and other deleterious iron-bearing minerals. San Diego and Riverside counties are furnishing practically all the feldspar produced in California at the present time. The principal deposits that have been opened up are in the vicinity of Campo, Dos Cabezas, Lakeside, and Jacumba. Probably the largest deposit in the state is located in the Campo district, being operated on an extensive scale by the *Pacific Sanitary Manufacturing* 

Company, of Richmond, California.

Feldspar is used in the ceramic industry, principally in pottery, porcelain, and enamel wares, also enamel brick and tile, being a constituent of both the body and the glaze, but more especially the latter. The requirements of the pottery trade demand that in general the percentage of free silica associated with the feldspar be less than 20% and in some cases the potteries specify less than 5%. An important factor also is the iron-bearing minerals, such as biotite (black mica), garnet, hornblende, and black tourmaline which are frequently present in pegmatites and granites. Feldspar for pottery use should be practically free from these. The white potash mica, muscovite, is not particularly objectionable except that, being in thin, flexible plates, it does not readily grind to a fineness required for the feldspar. Present quotations are from \$4 to \$10 per ton crude, according to quality.

Dehesa Cornwall Stone Deposit is an extensive deposit located in Sec. 27, T. 16 S., R. 1 E., S. B. M., on the north slope of McGinty Mountain. southwest of Dehesa. The American Encaustic Tiling Company, Los Angeles, mines and ships a large tonnage of this rock to its plant at Los Angeles. The material mined is a feldspathic rock which resembles orthoclase, but it is much lower in potash. It is called 'Cornwall stone,' due to its similarity to rock mined at Duroc, Cornwall, England. The product is hauled by motor truck to El Cajon, a station on the Cuyamaca branch of the San Diego and Arizona Railroad, a distance of seven miles.

Analusis	hu	company	chemist.
----------	----	---------	----------

Silica	77.68%
Alumina	15.97%
Lime	2.80%
Iron	0.13%
Manganese	0.72%
Alkalies	2.04%

99.34%

Dos Cabezas Feldspar Deposits are located in Sec. 22, T. 16 S., R. 8 E., S. B. M., one mile north of Dos Cabezas Siding, on the San Diego and Arizona Railroad. Owners are M. C. and M. A. Turner and associates, of San Diego. Exposures of feldspar occur here at various points along pegmatite dikes in the granite. These deposits of spar are undeveloped but the possibilities look favorable for the development of a tonnage, as the outcrops are numerous and extensive. At one place an opencut has developed 14 feet of spar which is of good quality, and unusually free from impurities such as black mica, hornblende and iron.

Lakeside Feldspar Devosit is located in Sec. 35, T. 15 S., R. 1 E., S. B. M., five miles east of Lakeside. Owners, M. C. and M. A. Turner, 923 G Street, San Diego. This deposit is developed by opencuts, and shows six feet of spar associated with silica. It occurs along a pegmatite dike in the granite, and the feldspar outcrops at a number of points within a distance of one mile along its general strike. The quality of spar is said to be good, with a high potash content. A considerable tonnage has been shipped.

Marden Feldspar Deposit is located five miles northwest of Jacumba. The holdings comprise 15 claims located along an outcrop of feldspar and silica that can be traced for a distance of five miles. The spar is of good quality. Two hundred tons of spar and 50 tons of clear silica have been mined. Both are being shipped to Los Angeles. Jack Marden, National City, owner.

Moore Feldspar Deposit is located in Sec. 36, T. 17 S., R. 8 E., S. B. M., four miles east of Jacumba. Holdings comprise 30 acres owned by Armon Moore of Los Angeles. Feldspar showing a width of from 2 to 4 feet, associated with quartz is exposed in an opencut. Fifty tons of spar of good quality are on the dump.

Mykrantz Feldspar Deposits. Feldspar and silica outcrops occur on the San Vicente Grant, four miles south of Ramona. In shallow opencuts made along the different outcrops, some spar of good quality has been exposed. Owner, J. W. Mykrantz, of Ramona.

Osborne Feldspar Deposit is located 1½ miles west of Campo, and about one mile north of the San Diego and Arizona Railroad. A number of claims have been located along extensive outcrops of spar. The material exposed is of good quality. R. C. Osborne of Oceanside, owner.

Pacific Sanitary Porcelain Company of Richmond, California, F. A. Kales, manager, owns and operates one of the largest feldspar deposits so far developed in the county, and probably the largest in California. The deposit is located on a ridge south of Cottonwood Creek, about five miles north of Campo.

A massive outcrop of silica and feldspar occurs in the granite, and is from 300 to 500 feet wide. It strikes northeast and extends for a distance of 1600 feet. The deposit has been opened up by an opencut 200 feet in width, and about 75 feet in height. The top of the outcrop is about 500 feet vertically above the floor of the opencut. The spar exposed in the face of the opencut is massive and of good quality,

being free from impurities. Intermixed with this are veins and boulders of quartz, which are sorted out when mined. The spar is loaded in cars, and trammed to an incline chute which delivers it to a 40-ton storage bin. In this chute there is a section of \(\frac{1}{4}\)-mesh screen, to eliminate dust and fine material. From bins the material passes over a 1-inch grizzly, over-size going to a 10" x 20" Blake crusher. This is crushed to pass a 3-inch ring. The 3-inch material goes to a revolving screen 4 feet long, with 3-inch openings. Here water is added to wash the material. The through-size material passes to a revolving screen 8 feet long, where it is screened to \(\frac{1}{2}\)-inch size. The over-size from both these screens is sent to belt conveyors, and conveyed to receiving bins.

The plant is operated by a Fairbanks-Morse Y-type gas engine. The company is shipping 1000 tons per month. The product is hauled by motor truck to a siding on the San Diego and Arizona Railroad, one

mile east of Campo. Twenty-five men are employed.

# FULLER'S EARTH.

Fuller's earth includes many kinds of unctuous clays. It is usually soft, friable, earthy, non-plastic, white and gray to dark green in color, and some varieties disintegrate in water. It has been used in California in clarifying both refined mineral and vegetable oils. Clays of the montmorillonite and halloysite group are being utilized by some of the oil refineries in lieu of true fuller's earth in the refining of petroleum products.

Montmorillonite (hydrous aluminum silicate) is a colloidal clay, locally called 'otaylite.' Deposits of montmorillonite occur on the mesas on both sides of the Otay River Valley. It forms a layer from 2 to 6 feet thick a few feet below the surface of the mesa, and underlying

several hundred acres.

California Clay Refining Company, of Los Angeles, operates a deposit located three miles east of Otay, on the mesa south of the Otay River Valley. An opencut about 100 feet in length exposed a bed of montmorillonite 4 to 5 feet thick, overlain by an overburden of sandstone and soil. The overburden is first stripped, and then the montmorillonite is moved by scrapers to loading bins. The material is hauled by motor truck to Palm City.

General Petroleum Company deposit is located on the John Mosto Ranch, three miles east of Otay on bluffs of the mesa south of the Otay River Valley. The deposit was formerly opened up and developed by Hamburger Company of Los Angeles. In 1918 it was acquired by the General Petroleum Company of Los Angeles. This company developed it for use in the refining of petroleum products.

The deposit has been opened up for a distance of 1000 feet, exposing a bank 20 feet high above the floor of the cut. The beds of montmorillonite lie horizontally, and are 6 to 8 feet thick, overlain by an overburden of sandstone and soil 10 feet thick. About two acres of ground have been excavated. This is used for a drying and storage

floor for the material mined.

The method of working consists in driving a series of laterals to the south. These are then mined out similar to working a horizontal bed of coal. The material from the underground workings is wheeled

out onto the floor of the opencut, and allowed to dry. A disk plow is then run over the material to break up large lumps, after which it is handled by scrapers to the loading platform, where it is loaded onto motor trucks and hauled to Palm City for shipment to the company's

refining plant at Los Angeles.

The montmorillonite is white, brown, and pink in color, and disintegrates readily when exposed to the air. Six to eight men are employed. The company has also an option on 640 acres of land on the R. E. Harrison Ranch, on the north side of the mesa, which is being prospected to determine the thickness of the beds.

#### GEMS.

Since 1911 the production of gem materials in San Diego has been somewhat irregular and uncertain. There has been a slight renewal of activity in the tourmaline district in the northern part of the county



Montmorillonite Deposit, General Petroleum Company, Otay, San Diego County.

during the past year. The value of the uncut gem materials produced during 1923 was \$8,530, and in 1924, \$1,925, these being principally tournaline, kunzite, essonite and spessarite garnets, aquamarine and

pink beryl, blue topaz, and quartz crystals.

The gems of California have been described at length in Bulletin 37 of the State Mining Bureau, by Dr. George F. Kunz, of New York City, whose long experience and commanding position in the gem trade of America have given him exceptional knowledge of materials produced, and for judging their quality. The gem deposits of San Diego County are also described in detail by Dr. Frederick H. Merrill in State Mineralogist's Report XIV, pp. 691–705. Owing to the limited time allowed for field work, only those properties that were producers in the past few years will be briefly mentioned in this report.

In San Diego County the principal sources of tourmaline, kunzite, and garnet, together with the less abundant beryl, topaz, and spinel, are pegmatite dikes of large size and substantial extent, often occurring

in diorite or gabbro. The most productive districts of gem-materials are Pala, Rincon, Mesa Grande, Moosa Canyon, Ramona, and Aguanga Mountain.

A. B. C. Gem Mine is located in the NW¹/₄ of the NW¹/₄ of Sec. 8, T. 13 S., R. 2 E., S. B. M., one mile northeast of Ramona. Owners, L.

B. Spaulding and C. A. Seay, San Diego.

The gem-material occurs in pegmatite dikes in granite. This mine has produced a large amount of pink beryl. The mine has been worked at intervals since 1907. The largest production came from what is known as the Old Daggett stope, narrow, irregular workings that followed the vein on its dip for somewhat over 100 feet. During the past year a new shoot of gem-bearing clay was found north of these workings.

Bibl: State Mining Bureau Bulletin 37, pp. 140-142; State Mineralogist's Report XIV, pp. 693, 702.

Douglas Claim is situated six miles east of Pala and adjoins the Stewart mine of the American Lithia and Chemical Company of New York. The gem-bearing pegmatite dike occurs in a hornblende granite, on Tourmaline Queen Mountain. Melvin R. Gay, Box 14, Los Angeles, manager.

Ed Fletcher Jr. Mine is located in the Pala gem district, east of Pala. Ed Fletcher and William Gross, San Diego, owners.

Hercules Group of Claims is located in the Ramona district, and comprises eight claims in Sec. 8, T. 13 S., R. 2 E., S. B. M., northeast of Ramona. A small producer of pink beryl. A. W. Pray and E. G. Logan, Escondido, owners.

Little Three Gem Mine is a patented claim, located in the NE¹/₄ of the SE¹/₄ of Sec. 8, T. 13 S., R. 2 E., S. B. M., about two miles northeast of Ramona. The gem material occurs in pegmatite dikes in the granite. Topaz is produced and here are found crystals varying in color from white to light yellow, and sea green to sky blue. Owners, H. W. Robb and Peter Schnack, Escondido.

Pala Chief Mine, the largest producer in the Pala district, comprises five claims known as the Pala Chief, Ocean View, Goddess, Hazel Wand, and Knickerbocker, located in Sec. 14, T. 9 S., R. 1 W., S. B. M., seven miles east of Pala, and one mile east of the Tourmaline Queen Mine. Owner, Pala Chief Gem Mining Company; Frank A. Salmons, president; R. Fenton, secretary, U. S. Grant Building, San Diego.

The Pala Chief dike is the largest of all the gem-bearing pegmatites. It is exposed on the west side of a summit of a hill at about 1500 feet in height. Its thickness varies from 30 to 50 feet, and it dips about 15° W. The hanging wall is a dark hornblende diorite, while the footwall is a biotite granite. The material, chiefly kunzite, occurs in a reddish clay in pockets of considerable size. One of these was 3½ feet high by 20 feet long. Lepidolite in small masses is of frequent occurrence. It has also produced considerable gem-tournalines, both red and green. The red or pink variety is called rubellite. This mine is also one of the chief sources of spodumene (kunzite), color lilae and pale pink to white.

Bibl: Bulletin No. 37, pp. 25, 31, 55, 60, 61, 87, 126, 127; State Mineralogist's Report XIV, pp. 691, 693, 694, 696-697, 707.

Sickler Mine comprises seven claims in Sec. 24, T. 9 S., R. 2 W., S. B. M., on Heriart Mountain, 1½ miles southeast of the Pala Chief Mine, and east of Pala. Elevation 1700 feet. Owner, M. M. Sickler, Pala. Here are numerous pegmatite dikes varying in direction and dip. The gem materials produced are beryl, tourmaline, and spodumene (kunzite).

Surprise Mine is located in the SW¹/₄ of the SW¹/₄ of Sec. 9, T. 13 S., R. 2 E., S. B. M., northeast of Ramona. Owner, J. W. Booth, of Ramona. The gem deposits occur in pegmatite dikes in the granite. The chief production has been topaz and beryl, both pink and green shades.

Tourmaline King Mine is located in the Pala district on Tourmaline Queen Mountain, about seven miles east of Pala and at a higher elevation than the Tourmaline Queen mine. Owner, R. M. Wilke, Palo Alto, California. It is on a pegmatite dike parallel to the Tourmaline Queen dike. The outcrop of this dike is on the north face of the summit of the mountain, the vein being about 7 feet wide and dipping 40° NW. The gems produced are beryl, tourmaline, and kunzite.

Tourmaline Queen Mine is located on Tourmaline Queen Mountain, and comprises three claims in Secs. 15 and 22, T. 9 S., R. 1 W., S. B. M., six miles east of Pala. Owner, Pala Chief Gem Mining Company, of San Diego. It is on a pegmatite dike that runs parallel to the American Lithia Company's dike, and about 600 feet higher on the mountain. The dike is about 14 feet wide, dips southwest 15°, and can be followed a considerable distance south. The workings are quite extensive. The gems produced are beryl, tourmaline, and some kunzite.

J. W. Ware, Sixth Street, San Diego, is reported to be operating the *Mountain Lily Mine*, six miles southwest of Oak Grove in the Aguanga Mountains.

The dike is said to be four feet wide in diorite, the gem-bearing vein being on the contact between the pegmatite and the hanging wall of diorite. The principal gem produced is a Nile green tourmaline.

# GRANITE.

Granite occurs in great variety and abundance, and in excess of all possible future demands. The principal commercial deposits are located near Santee, Lakeside, and Escondido. Near Lakeside is a fine-grained 'silver gray' granite of uniform texture and color, that is especially suitable for monumental and ornamental work. Near Escondido is a deposit of dark hornblende-diorite, which is particularly suitable for monumental and decorative purposes.

The following companies and individuals are now operating:

Bernardo Granite Quarries are located on the Bernardo Ranch, near the south bank of Lake Hodges, seven miles south of Escondido. Owner, San Diego County Water Company. The quarries have been opened up on a belt of black granite, that has a general northerly strike. The granite is a hornblende-diorite, black in color, and of uniform texture and quality. The Van Deventer quarry is a small opening made on some large boulders.

Equipment consists of a 30-foot derrick, 6" x 6" Curtis compressor, 15-h.p. Fairbanks-Morse gas engine. The stone is used for monumental

purposes.

Covas Granite Quarry is located on the El Cajon Rancho, one mile south of Santee, in a low range of hills east of El Cajon and Lakeside road. Owner, J. E. Covas, of Oxnard.

Here a small quarry has been opened up on the southwest slope. The stone is a granodiorite, light gray in color, and quite uniform in



Block of Silver Gray Granite in Eucalyptus Quarry No. 2, Lakeside, San Diego County. Photo by W. A. Meyer.

both texture and color. Production amounts to about two cars per year. This is used for monumental purposes.

Eucalyptus Ranch Quarry. W. A. Meyer, of Lakeside, owns and operates two quarries located in Secs. 1 and 2, T. 15 S., R. 1 W., S. B. M., two miles north of Lakeside. Holdings comprise 2500 acres,

of which 80 acres cover a silver-gray granite deposit.

No. 1 Quarry: Is located in Sec. 1, on a belt of silver-gray granite from 50 to 100 feet wide, that strikes east and dips 70° N. The stone is a light gray fine-grained granite, quite uniform in both texture and color. For the most part the rock is massive and almost free from open seams. It has a remarkably straight fracture, and is easily obtained in large rectangular blocks.

Equipment consists of a 100-foot derrick and 90-foot boom, derrick hoist driven by a 35-h.p. gas engine, 10" x 10" Curtis compressor

driven by a 50-h.p. Western gas engine.

This silver-gray granite for monumental purposes brings \$3.60 per cubic foot, at the quarry, and \$4 per cubic foot on cars at Lakeside.

No. 2 Quarry: Is located in Sec. 2, on a belt of dark-blue biotitegranite which strikes northeast and is about 600 feet wide. The stone is quite uniform in texture and color. The quarry has opened up a face of granite 150 feet in length and 75 feet above the floor of the quarry. Along this face are vertical and horizontal joint planes about

20 feet apart.

Equipment consists of a 75-foot derrick, derrick hoist, and 12" x 12" Curtis compressor driven by a 35-h.p. Samson gas engine. A stone polishing plant driven by a 40-h.p. electric motor is on the property. This plant consists of polishing and surfacing machines. The shipping yards with loading derrick are located at Lakeside, a station on the Cuyamaca branch of the San Diego and Arizona Railroad. Twelve men are employed.



Silver Gray Granite, Eucalyptus Ranch Quarry No. 2, Lakeside, San Diego County. Photo by W. A. Meyer.

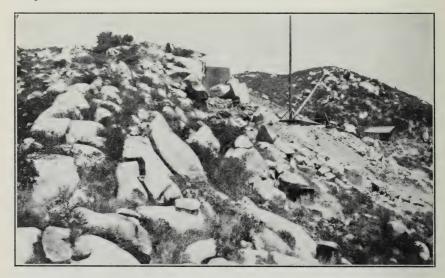
Chemical Analysis of the Silver-gray Granite by Smith-Emery Company.

Chemical Analysis of the Silver gray Grantle by Smith	Emery Company.
Silica (SiO ₂ )	
Alumina (Al ₂ O ₃ )	
Ferric Oxide (Fe ₂ O ₃ ) as Fe ₂ O ₃	3.18%
Ferrous Oxide (FeO) \( \)	
Titania (Tio)	0.30%
Manganese Oxide (MnO)	0.28%
Lime (CaO)	2.12%
Magnesia (MgO)	0.82%
Combined water (H ₂ O)	0.28%
Soda $(Na_2O)$ by difference	6.84%
Potash (K2O) f by difference	0.04%
Matal	100,000

Ireys Black Granite Deposit is owned by Dr. J. T. Ireys of Los Angeles. Under lease to Arthur Greenleaf of Lakeside. The deposit is located two miles northeast of Lakeside. The stone is hornblendediorite of good quality. The granite taken out is obtained from boulders on the surface. A small gasoline engine, air compressor, have been installed, and a small quantity of rock quarried.

McGilvray Raymond Granite Company. Office 678 South Utah Street, Los Angeles. The quarry is located 7½ miles west of Foster, in

the  $E_{\frac{1}{2}}$  of the  $SE_{\frac{1}{4}}$  of Sec. 35, T. 14 S., R. 1 W., S. B. M. It is owned by  $Simpson-Pirnie\ Granite\ Company$  of San Diego, but is operated under lease by the McGilvray Raymond Granite Company. Holdings comprise 11 acres.



Showing Belt of Silver Gray Granite, McKoon Granite Quarry, Lakeside, San Diego County.



Face of McKoon Granite Quarry, Lakeside, San Diego County.

Two quarries have been opened up on a belt of silver-gray granite that strikes east and is about 500 feet wide. The upper or west quarry exposes a face of granite 100 feet in length by 75 feet in height above the floor of the quarry. The east quarry exposes a face of stone about 150 feet in length. The stone appears to be more uniform, of

better quality, and freer from seams and joint planes than the west quarry. The stone is a light-gray fine-grained granite, which takes a beautiful polish and is in great demand for monumental purposes. This granite is sold for \$3.60 to \$4 per cubic foot.

Equipment consists of two derricks 125 feet high, two American derrick hoists driven by electric motors, Ingersoll-Rand Imperial type (8" x 13") (13" x 12") compressor driven by 75-h.p. Westinghouse motor, blacksmith shop, and air drills. Twenty-five men are employed.

McKoon Silver-Gray Granite Quarry is located two miles west of Lakeside in Sec. 10, T. 15 S., R. 1 W., S. B. M. Holdings comprise 830 acres of patented land. Owner, Hosmer McKoon, Lakeside. The deposit lies near the summit of a low range of hills north of El Cajon Valley. Elevation 600 feet.

This belt of silver-gray granite strikes north to northwest, and is 600 feet in width. The exposure of this stone can be followed for a distance of about one mile along its strike. On a hill west of the quarry are large boulders of granite, any one of which will supply a great amount of dimension material. The stone is light gray and fine-grained, quite uniform in texture and color, has a remarkably straight fracture, and can be easily obtained in rectangular blocks as large as can be handled. There is little stripping and very little expensive waste in quarrying. The granite face exposed is about 200 feet in length and 75 feet high. This quarry was opened up in 1924 and the first carload shipped in May, 1925. This material is in demand for monumental work, as it takes a very beautiful polish.

Equipment consists of a 125-foot derrick and a Clyde derrick hoist capable of lifting 10,000 pounds on a single line; a 12" x 10" Sullivan compressor. Hoist and compressor are driven by a 70-h.p. St. Marys

Diesel-type engine. Fifteen men are employed.

# Chemical Analysis by Company Chemist.

Silica (SiO ₂ )	74.07%
Alumina $(Al_2O_3)$	16.42%
Iron $(\mathrm{Fe_2O_3})$	1.31%
Lime (CaO)	1.71%
Soda (Na ₂ O)	1.10%
Potash (K ₂ O)	4.72%
Water uncombined	0.39%
Combined water	
Total	100.00%

Rossi Quarry is located in Sec. 3, T. 15 S., R. 1 W., S. B. M., 1½ miles west of Foster. Owner, Dan F. Rossi, 3845 Imperial Avenue, San Diego.

The stone is a silver-gray granite with brownish tint on the weathered outcrop. Most of the material quarried has come from massive

boulders. The quarry has been opened in two benches.

Equipment consists of a derrick 75 feet high, derrick-hoist, and 6" x 6" Gardner compressor, the latter driven by a 10-h.p. motor. The material is used for monumental purposes at the owner's plant in San Diego. Three men are employed.

Simpson-Pirnie Granite Company. James Simpson, president; Peter Pirnie, secretary. Office and works in San Diego. The property com-

prises 49 acres located near Santee Station on the Cuyamaca branch

of the San Diego and Arizona Railroad.

The stone is granodiorite, locally called Santee granite, and is light gray in color. The rock is massive and free from open seams. It has a remarkably straight fracture, can be quarried in large blocks, and is quite uniform in texture and color. It is largely used for monuments. For this purpose it is cut and dressed at the company's yard in San Diego, whence it is shipped in considerable quantities to Los Angeles and other points in southern California. It also makes good building stone, for which it has been used to some extent. The production is made up of dimension stone, paving blocks, and riprap. The quarry is 200 feet in length by 75 feet high. Spur track to the quarry from the railroad.

Equipment consists of a 100-foot derrick, derrick hoist, compressor, and air drills. Electric power is furnished by the San Diego Con-



Dark Blue Santee Granite, Simpson-Pirnie Granite Quarry, Santee, San Diego County.

solidated Gas and Electric Company. Eight men to ten men are employed.

Stockdale Granite Quarry (Ebony Black Granite Quarry) comprises 30 acres located in Sec. 30, T. 12 S., R. 2 W., S. B. M.,  $3\frac{1}{2}$  miles southwest of Escondido. Owners, Thomas Stockdale and W. Walker of Escondido.

Two quarries have been opened up on a ridge north and west of the Escondido River, on an outcrop of black granite that strikes northeast and is about 200 feet wide. The stone being quarried is a black hornblende-diorite and is quite uniform in texture and color. It is largely used for monumental purposes, also for building stone. The stone is being taken from large boulders that form the outcrop on top of the ridge.

Equipment consists of two 30-foot derricks with 28-foot booms, 6" x 6" Gardner-Rix compressor, and 15-h.p. gas engine. The quarry has been under operation for the past three years. From 200 to 300

cubic feet of stone is shipped to Los Angeles each month. Four men are employed.

## GRAPHITE.

Kane Graphite Mine (Leebrick Mine) comprises 120 acres of patented land located in Sec. 10, T. 14 S., R. 5 E., S. B. M., on the southwest side of Mason Valley, 12 miles southeast of Julian. Owner, P. J. Kane of Julian. Elevation is between 2600 and 2700 feet. The workings consist of a tunnel driven N. 45° W., 125 feet, with a drift driven N. 80° W. on the edge of graphite schist, and several small opencuts.

The deposit is a band of graphitic schist with a maximum width of 80 feet, which is traceable for a length of about 400 feet. At the south end these schists strike N. 80° W., but farther northwest the strike is N. 45° W. The average dip is about 65° NE. The graphitic schists terminate on the southeast, just below the main tunnel. Beyond this point occur only granite, gneiss, and pegmatite. The schist carries about 11% graphite. The graphite occurs as crystalline 'flakes' disseminated through the schist. The flakes are less than 0.2 millimeters in diameter.

Seyer Graphite Mine is four miles east of Mason Valley, in Sec. 34, T. 13 S., R. 5 E., S. B. M. The deposit occurs as two graphite bands of schist 4 to 12 feet wide. Most of the graphite forms minute flakes, a small fraction of a millimeter across a fine-grained schist, but scattered through the schist. According to reports, showed 16.2% graphite. Owner, W. B. Sever of Julian, California.

#### JASPER.

A deposit of red and white-banded jasper occurs southeast of Dulzura. Dr. C. C. Valle of San Diego, owner.

# ORBICULAR GABBRO.

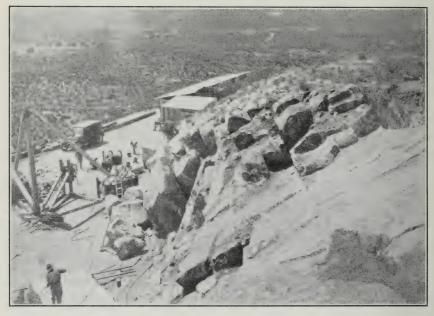
About six miles east of El Cajon on the north bank of the Sweetwater River and about one mile west of Dehesa, in Sec. 15, T. 16 S., R. 1 E., S. B M., is a large mass of gabbro, portions of which have an orbicular structure and show a highly ornamental surface when polished. This gabbro is intrusive in the midst of granite. It outcrops over an area of about a square mile on a hill near Dehesa, and extends three or four miles southwest. For a full description of the deposit see State Mineralogist's Report XIV, pp. 674-676, and State Mining Bureau Bulletin No. 38, pp. 56-61.

## LIMESTONE AND MARBLE.

In San Diego County crystalline limestone occurs at many points in the areas of metamorphic rocks. The development of these deposits has been retarded due to lack of transportation in the regions where they occur. Very extensive deposits of limestone are located 4½ miles northeast of Dos Cabezas Springs, being within one mile of the San Diego and Arizona Railroad. The Verruga Marble Company owns extensive deposits of marble in Verruga Valley, southeast of Warner Hot Springs. The development of this deposit has been delayed on account of its distance from transportation.

Dos Cabezas Limestone Deposit comprises 480 acres in Secs. 22, 23, 26, and 27, T. 16 S., R. 8 E., S. B. M., one mile north of Dos Cabezas Siding on the San Diego and Arizona Railroad, and nine miles north of Jacumba. Elevation 1650 to 1800 feet. Owners, M. C. and M. A. Turner and associates of San Diego.

Beds of white crystalline limestone occur in several small hills north of Dos Cabezas Siding. The limestone beds are cut by intrusions of schist and granite, and near the contact of the limestone and granite the formation is quartzite. The general strike of the limestone beds is N. 30° W., with a dip 60° NW. The belt is about one mile in length along the strike, and about three-fourths of a mile wide. One stratum extending about 600 feet in length and 20 feet in width, is pure white interspersed with tiny black dots. This stratum is a white marbleized



South Quarry, Verruga Marble Company, Verruga, San Diego County.

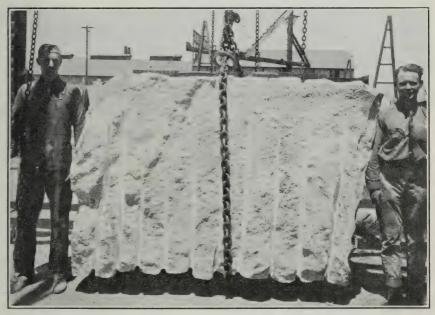
Photo by G. Landweer.

limestone of high grade, fine-grained, slightly harder than common marble, and said to take a high polish. The different beds vary in thickness from 20 to 100 feet, and are from 300 to 600 feet in length. The largest exposure of limestone on the property is about 1½ miles north of the siding. Here a hill rises to an elevation of 800 feet above the floor of the desert. This massive bed is about 3000 feet in length by 500 feet in thickness. The limestone, where exposed by opencuts, is a coarse white crystalline lime. Analysis of samples is reported as 98% CaCo₃. No attempt to estimate probable tonnage was made, but it would be quite large, and would be especially suitable to furnish a sufficient tonnage for the manufacture of cement.

Deer Park Limestone Deposit is located on the Schley Group of claims in Secs. 1 and 12, T. 15 S., R. 4 E., S. B. M., on the ridge east



North Quarry, Verruga Marble Company, Verruga, San Diego County. Photo by G. Landweer.



Block of Marble, Verruga Marble Company, Verruga, San Diego County.

Photo by G. Landweer.

of Indian Creek, eight miles northeast of Descanso. An opencut has exposed a lens of white crystalline limestone 15 feet wide. This limestone was formerly burned in a kiln on Indian Creek for use at the Stonewall mine. Owner, C. M. Walker of Descanso.

Verruga Marble Deposit comprises eight claims located in T. 10 S., R. 4 E., S. B. M., on the west slope of the San Ysidro range of mountains, one mile north of Verruga, Post Office, and 21 miles northeast of Santa Ysabel. Elevation 4500 feet. Owners, Verruga Marble Company; C. Harlow, president; Frank C. Webb, treasurer; W. B. Goss, secretary, San Diego.

This company opened up the quarry in 1921 and operated until 1923. At that time the property was completely equipped, both for quarrying and sawing, and polishing the material. All this equipment has been removed. Operations were suspended on account of the cost of transportation, the nearest railroad point being Lakeside on the

San Diego and Arizona Railroad, a distance of 52 miles.

Where this deposit occurs the formations are metamorphic, consisting of mica schist, gneiss, quartzite, and limestone adjacent to a large granite area. The deposit occurs as two belts of coarsely crystalline limestone that strike N. 20° W., and dip 60° W. These belts are about 800 feet apart, and between the two outcrops is a band of mica schist. The west belt is about 100 feet wide, and can be traced for a distance of 1000 feet along its strike; while the east belt has a width of about 200 feet, and can be followed for a distance of 1000 feet.

Two quarries about 200 feet apart have been opened up on the west belt, and the stone exposed is a massive white crystalline marble of even texture and uniform in color and quality. The stone is a calcite marble, analysis showing 92% CaCo₃. It is hard and impervious to weather action. It weighs 179 lbs. per cubic foot, running 12 cubic feet to the ton. The conditions for quarrying large blocks are favorable, and when the quarry was under operation massive blocks of marble weighing 160 tons were taken out. The marble is very similar to Tate, Georgia product, but said to be harder. It is estimated that the deposit contains one million cubic feet of mercantile marble. The cost of hauling the material to Lakeside is \$8 per ton.

The marble has been used in the following buildings in San Diego: San Diego Hotel Annex, Colonial Theater, Otto Building, Seiffert Building, Walk Over Shoe Store, also for the milestone for Lee High-

way on the Plaza opposite Grant Hotel.

Volk Marble Deposit comprises two claims located north of the Verruga Marble deposit, being an extension of the above-mentioned outcrops of limestone. Owner, H. Volk of San Diego.

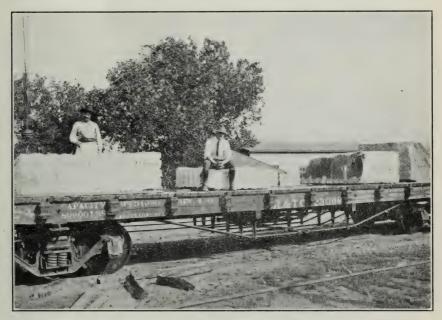
Other Outcrops of Limestone: E. Jacobs Ranch, three miles south of Ramona; another near Jacumba in Sec. 2., T. 18 S., R. 8 E., S. B. M., which is a dark-gray marbleized limestone. A deposit of marble is located on top of the ridge about three miles due east of the Verruga deposit. The marble is said to be similar in character and quality to the Verruga deposit, but is inaccessible.

LIME suitable for fertilizer (agricultural lime) occurs as calcareous layers not far below the surface on Otay Mesa, near Otay and two miles north of Lakeside in Secs. 1 and 2, T. 15 S., R. 1 W., S. B. M.

Lakeside Lime and Marl Deposit is located on the El Cajon Rancho, two miles north of Lakeside, on land owned by W. A. Meyer of Lakeside. The calcareous layers are from 2 to 4 feet thick, covered with soil overburden of no great extent. The material occurs on 400 acres in Secs. 1 and 2, T. 15 S., R. 1 W. It has been used locally as agricultural fertilizer by fruit growers and farmers of the district. A determination made of the lime carbonate by the Department of Agriculture of the State of California is as follows: Calcium carbonate (CaCo₃) = 83.7%. Grade: Medium to high agricultural lime.

A 50-ton grinding plant has been installed on the property, where the marl is ground and screened to 20-mesh. This product is sold to

the farmers at \$8 per ton at the plant.



Shipment of Verruga Marble, from Verruga Marble Quarries, San Diego County.

Photo by G. Landweer.

# LITHIA.

Lithia mica or lepidolite, utilized in the manufacture of artificial mineral water, fire works, and glass, has been mined in San Diego County since 1899. Some amblygonite, a lithium phosphate, has been obtained from pockets associated with the gem-tourmalines. The lepidolite marketed is principally used by glass manufacturers. The lithia minerals occur in San Diego County on a northwesterly trending axis, parallel to the strike of the granite ranges, and extending from the Old Royal mine southeast of Banner, through Mesa Grande to Pala.

The Royal Mine lies southeast of Banner on the southwest slope of Granite Mountain, in Sec. 18, T. 13 S., R. 5 E., S. B. M. Lepidolite occurs here in a pegmatite dike.

At Mesa Grande lepidolite occurs in small masses, in the gem-bearing veins on the San Diego, Himalaya, and Esmeralda properties. No

commercial production was made from these mines. This widespread and persistent lithia mineralization culminates at Pala, where are the commercially important deposits of lepidolite and also of the gemmineral kunzite.

On the east side of the Tourmaline Queen Mountain, about 400 feet above the base, is exposed a great pegmatite dike 35 to 45 feet wide, which strikes north and dips south 5 to 10 degrees. It is exposed for a length of 3000 feet, from north to south, and has been opened at several points. Filling a fissure in this dike is a vein of lepidolite from 15 to 20 feet thick. Throughout the lepidolite, radiating masses of rubellite or pink tourmaline occur abundantly, and in occasional pockets are masses of amblygonite. The principal portion of this lithia vein is controlled by the American Lithia and Chemical Company, 206 Broadway, New York City.

The Pala Lepidolite Deposit is of great size, and its tonnage has been estimated at from 500,000 to over 1,000,000 tons. Small masses of lepidolite are found in the veins of the Tourmaline Queen and Tourmaline King mines, on the same mountain. In the Pala Chief vein the lithia mica occurs in small quantities.

The only commercially productive mine at present in the district is the Stewart Mine, owned by the American Lithia and Chemical Company. This property is only operated at intervals, according to demand from chemical and glass manufacturers.

demand from chemical and glass manufacturers.

Stewart Mine comprises the Douglas, Mission, and Stewart claims, owned by the American Lithia and Chemical Company, 206 Broadway, New York City. Wm. N. Crane, President; Theo. Luddum, secretary.

#### MICA.

This material is not abundant in San Diego County, but occurs in the Jacumba district along outcrops of feldspar and silica that occur in the granite area. The ocurrence is small, but there may be a possibility that it might be sorted out of the deposits for use as ground mica.

#### MINERAL PAINT.

A bedded deposit of the mineral, pinite, occurs eight miles northeast of Encinitas in Secs. 3 and 10, T. 13 S., R. 3 W., S. B. M. The deposit is traceable for a distance of some 4000 feet, its strike being nearly east, and its dip 45° N. It varies from 70 to 100 feet in width, and is underlain by diorite which forms the footwall, while the hanging wall is basalt. Near the footwall its color is reddish and yellowish, while toward the hanging wall it grows lighter in shade, passing from light yellow and gray to white. About 12 feet of this width is said to be of commercial value.

Bibl: State Mineralogist's Report XIV, pp. 668, 689-691.

# SILICA (SAND AND QUARTZ).

A number of deposits of silica are found in San Diego free from iron and other impurities and suitable for use in glazes for porcelain, pottery and tile. Manufacturers of paint use finely ground silica, which forms as much as one-third of the total of some pigments for paint. The principal deposits are located near Campo, Jacumba,

Boulevard, Ramona, Lakeside, and Escondido. At present writing shipments are being made from the Marden and the Walker deposits near Jacumba, to Los Angeles. In the past a considerable tounage of sand suitable for the manufacture of glass was shipped from the beach sand near Oceanside, but this material has been entirely replaced by sand imported from Belgium.

American Encaustic Tiling Company, Los Angeles, owns a deposit of silica located two miles south of Boulevard, and six miles west of Jacumba. The deposit is a massive outcrop of quartz, about 60 feet wide and 200 feet in length, which occurs on top of a ridge in the granite area between Boulevard and Jewell Valley. The quartz is clear white, and in the openings made along the outcrop are veins and bunches of feldspar associated with the quartz. The deposit is being developed to determine its extent and quality. The silica so far exposed seems to be free from iron stain.

Beeman Silica Deposit is located between Vista and Oceanside. F. H. Beeman, 1311 E. 83d St., Los Angeles, owner. The deposit is said to be under lease to Walter Ransome, Los Angeles.

Benton Ranch Deposit. A number of bold outcrops of silica occur near Laguna Junction and six miles east of Descanso. These are northeast of the main highway to Jacumba. The quartz is clear white, and the various outcrops are extensive. No attempt has been made to develop the deposits, owing to their distance from railroad transportation.

Borden Deposit is located two miles east of Carlsbad. Undeveloped. Owner, Carol Borden of Carlsbad.

Burroughs Silica Mine comprises two claims located in Jewell Valley in Sec. 8, T. 18 S., R. 7 E., S. B. M., four miles southwest of Boulevard and seven miles west of Jacumba. Owner, J. W. Risley of San Diego.

A massive outcrop of quartz 60 feet long by 12 feet wide, and 20 feet in height occurs on the Burroughs claim in a decomosed granite. The quartz is clear white and free from iron stain and mica. Analysis:

Silica (SiO₂) 99.5%; Iron (Fe₂O₃) 0.04%; Alkalies 0.01%.

On the Delphos claim one mile east of the Burroughs deposit is an outerop of quartz located on the north slope of a round hill which is about the same size as the above-mentioned deposit. Analysis: Silica  $(\mathrm{SiO}_2)$  99.2%. These deposits are within three-fourths of a mile from the railroad.

Dos Cabezas Deposits. Outcrops of quartz occur one mile north of Dos Cabezas Siding, on the San Diego and Arizona Railroad, in Sec. 22, T. 16 S., R. 8 E., S. B. M. These deposits are undeveloped, but the outcrops are extensive, and considerable clear silica could be developed. Owner, M. A. and M. C. Turner of San Diego.

Lakeside Silica Deposit is located five miles west of Alpine. Owner, M. A. Turner, San Diego. Outcrops of quartz occur within a distance of one mile along a general northwesterly strike. The principal outcrops are in Sec. 35, T. 15 S., R. 1 E., S. B. M. Quartz is associated with feldspar.

Marden Silica Deposit is located five miles northwest of Jacumba. Fifteen claims have been located along outcrops of quartz that can be followed for several miles along their strike. Considerable tonnage has been mined. The quartz is clear white, with a small amount of iron stain. Owner, Jack Marden, National City.

Osborne Silica Deposit is located 1½ miles west of Campo. Silica said to be of good quality occurs here associated with feldspar. Owner, R. C. Osborne, Oceanside.

Potrero Silica Deposit. This deposit is located in the range of mountains one mile east of Cottonwood Creek and about eight miles west of Potrero. A large outcrop of quartz 50 feet wide, associated with feldspar, occurs on the crest of the ridge. The quartz is clear white, and is reported to be very pure. Due to its inaccessibility and distance from transportation the deposit has not been developed.



G. R. Daley Rock and Gravel Plant, Murphy Canyon, San Diego County.

San Vicente Deposits. A number of outcrops of quartz occur on the San Vicente Ranch, owned by J. W. Mykrantz of Ramona. These outcrops have a general northeast strike, and where exposed, are from 6 to 12 feet wide. The quartz is white, but shows considerable iron stain along the fractures.

Sweetman Silica Deposit is located in Jewell Valley, seven miles west of Jacumba. Owner, J. W. Sweetman of Jacumba. The deposit consists of a number of outcrops of quartz that occur in the granite. Undeveloped.

Walker Silica Deposit is located in Jewell Valley, seven miles west of Jacumba. A massive outcrop of white quartz occurs on a small round hill which appears to be mostly made up of quartz. The quartz is clear white in places, but shows considerable iron stain. Opencuts made on the east side of the hill have developed quartz 80 feet in length by 20 feet wide, and 40 feet high.

Bins and loading chute have been installed and the product is hauled to Jacumba for shipment to Los Angeles. Six men are employed. Owner, Chas. Walker, Jacumba. Under lease to Jack Marden of National City.

# CRUSHED STONE, GRAVEL, AND SAND.

San Diego County has an extensive area of intrusive felsite, which is now quarried at Spring Valley and could be quarried at other points. The gravel of Otay River Valley, Sweetwater, and San Diego rivers is mostly felsite with some other volcanic rock of similar qualities.

# Rock and Gravel Plants.

Daley Sand and Gravel Plant. G. R. Daley of 4430 Boundary Street, San Diego, operates a plant in Murphy Canyon, north of Mission Valley, nine miles north of San Diego. The plant has a capacity of 300 cubic vards per day. The gravel pits are in Murphy Canyon.

north of the plant.

The gravel is transported to the hopper by scrapers, where it is loaded onto a train of two 4-ton side-dump cars, and hauled by Plymouth gasoline motor to receiving bins. The material from these bins goes to a revolving scalping screen, where it is screened to pass a 2-inch ring, oversize from the screen going to a No. 5 Wheeling jaw crusher. Through-size falls onto belt conveyor and goes to washing plant. The product from the No. 5 Wheeling crusher goes to an Austin gyratory crusher, where it is crushed to pass a 2-inch ring. The product from the gyratory crusher joins 2-inch product from the screen on a 30-inch conveyor belt and is transported to the washing plant. At the washing plant revolving screens produce a washed gravel of the following sizes: 2", 1\frac{1}{4}", 1", \frac{1}{2}", \frac{1}{4}", and washed sand. The plant is driven by electric power, 100-h.p. being the total used. Ten men are employed.

Fenton-Parker Materials Company; H. G. Fenton, president; G. S. Parker, secretary. Offices, 1245 National Avenue, San Diego. This company has four plants under operation, located at Chollas Valley, Otay, Spring Valley and Murray Canyon, and a sand plant at Riverview.

Chollas Valley Plant. This plant is located in Chollas Valley, three miles east of San Diego. Capacity of plant is said to be 250 yards per day. Crushed stone from cobbles, and gravel from canyon wash are used. Plant consists of conveyors, jaw crushers, and revolving screens. Products are 2", 1", ½" to ¼", and sand. These products are well washed in the washing and screening plant. Plant operated by electric power. Total 100-h.p. Eight men are employed.

Otay Plant. The plant is located near the town of Otay, on the Otay River, about one-quarter mile east of the San Diego and Arizona Railroad tracks. A spur track from this railroad to the yards of the plant affords railroad transportation. The company controls 160 acres along the river bed in Secs. 22 and 23, T. 18 S., R. 2 W., S. B. M., and the plant is located in the NW¹/₄ of the SW¹/₄ of Sec. 22. The capacity of the plant is 1000 tons per nine-hour day. The gravel from the river bed is delivered into a train of two 4-yard side-dump

cars by a Northwest Engineering Company 40-h.p. gasoline-driven bucket hoist, and is hauled by a Plymouth gasoline motor to the plant. Here the material is dumped over grizzly bars of railroad iron spaced nine inches apart, then to a steel hopper. From the hopper material is fed to a 32-inch belt conveyor, and transported to a 4-inch grizzly, the plus 4-inch size to an Austin crusher, the minus 4-inch size to a revolving screen where it is screened to pass a 2-inch ring, and is then conveyed to the washing plant. Over-size from the screen goes to a No. 3 Gates gyratory crusher, and the product is returned to a revolving screen, where it is screened to pass a 2-inch ring. It is then conveyed to the washing plant where it is screened by a Gilbert system of screens, and log washers for sand. The products consist of 2", 1", ½" to ¼", and washed sand. The sand produced is of two grades, coarse for concrete, and fine mortar. Capacity of storage bins is about 3000 tons. After the bins are full, material of 1-inch and 2-inch



Fenton-Parker Materials Co., Rock and Gravel Plant at Otay, San Diego County.

size is transported to stock piles at the yard. Electric power rated at 220-h.p. is used. Fifteen men are employed.

Murray Canyon Plant is located in Murray Canyon north of Mission Valley, about five miles north of San Diego. The plant was formerly operated by T. L. Barnes of San Diego, but recently acquired by the Fenton-Parker Materials Company. Holdings comprise 160 acres

extending north along Murray Canyon.

From banks along the canyon the gravel is delivered into three 5-yard side-dump cars by a Northwest Engineering Company gasoline shovel. The train is hauled to the plant by a 60-h.p. Plymouth gas engine. Here the material is dumped over a 12-inch grizzly to the hopper, from which it is conveyed by belt conveyor to a No. 5 Wheeling crusher, where it is crushed to pass a 3-inch ring. From the Wheeling crusher the product is conveyed to a scalping screen where it is screened to 2-inch size. The over-size from this screen goes to a No. 4 Gates gyratory and a 3-F Telsmith crusher, the crushed product being

returned to the revolving screen. It is then elevated to the washing plant, and screened by Gilbert type of screens. The following products are produced: 2",  $1\frac{1}{2}$ ", 1",  $\frac{1}{2}$ " to  $\frac{1}{4}$ ", and sand. Due to the amount of clay mixed with the gravel a large amount of water is required for the washing plant, 600 gallons of water being used per minute. Also instead of using log washers for sand, a Dorr type of classifier is used, eliminating the silt. The plant has a capacity of 1000 tons per 9-hour day. Rated horsepower required to operate the plant is 240-h.p. Water for the plant is pumped from six wells in Mission Valley. Output is sold by the ton, and the trucks are weighed on scales at the plant. Fifteen men are employed. T. L. Barnes, superintendent.

Spring Valley Plant. The quarry is southwest of Spring Valley Station, on the San Diego and Arizona Railroad, on the west side of the track. The crushing plant is located on the east side of the railroad at the same point. The rock is a fine-grained felsite which forms the hill immediately north of Lemon Grove, rising some 300 feet above the mesa level. The production of crushed stone, when operating to

capacity, is 500 tons per day.

The quarry face is 250 feet in length, and 100 feet above the floor of the quarry. The stone from the quarry is loaded in Kalbaugh carts, capacity being 1½ tons, onto cars having a capacity of 2½ tons. These cars are run by gravity to the bins at the plant, where the material is crushed by a No. 8 Gates gyratory crusher to pass a 6-inch ring. It is then elevated to a revolving screen, which has  $2\frac{1}{2}$ -inch holes on the inside, with outside jacket of 2-inch openings. The  $2\frac{1}{2}$ -inch and over goes to a No. 4 Gates gyratory crusher; the over-size from the 2-inch jacket goes to a 24-inch Symonds disc crusher. The material from the Symonds disc joins the 2-inch size from the screen and is carried by a 30-inch belt conveyor to the revolving screen, of which the inside screen is 11 inches, with a half-inch screen on top of the  $1\frac{1}{4}$ -inch and with an outside jacket of  $\frac{5}{32}$ -inch. The final product consists of 2", 1", 1" to 1", and dust. The dust is conveyed to the dust The crushed rock is stored in bins having a capacity of 800 tons; also on the ground in the yard. The plant is operated by electrical power, the total being 225-h.p. When operating to capacity thirty-five men are employed.

Sand Plant. This plant is located at Riverview, between Santee and Lakeside. The sand is obtained from the bed of the San Diego River. The sand from the river bed is elevated to a screening plant where it is washed and goes direct to railroad cars on the Cuyamaca branch of the San Diego and Arizona Railroad. It is then shipped into the company's yards at San Diego for building sand. Two men are employed.

Nelson and Sloan Gravel Plant is located near the town of Otay, on the Otay River. Owners, M. L. Nelson and F. R. Sloan of Chula Vista. The plant has a capacity of 200 cubic yards per day. The products are 2", 1", ½" to ¼", and washed sand. The plant is operated by electric power, the total being 84-h.p. Six men are employed.

A number of small sand and gravel plants are in operation in Mission and Otay valleys. These plants are operated steadily on account of the demand for building material in San Diego. The operators are: R. G. Fenn and John Hansen of San Diego; I. W. Grove and Son of

San Diego; Nelson Cooper Company of Otay; Jones and Klingers of Mission Valley; Hans Severtson of San Diego.

## PETROLEUM.

Petroleum of commercial value has not yet been discovered in this county, although a number of wells have been drilled, and are being drilled, and the operators of these seem quite hopeful of success. While most of the wells which have been or are drilling report showings of oil and gas, the significant fact is that no actual production of oil has been obtained. These is apparently a total lack of any actual evidence of petroleum such as seepage or gas blows. The principal formations that furnish oil in California are not found in San Diego County. The upper Cretaceous strata, which probably constitute a large part of the sedimentary beds of the county, are not commercially productive in other parts of California, and there is nothing to indicate that they will be productive in the southern part of the state. Eocene strata, although of the same age as oil-bearing strata in other parts of California, do not appear to contain oil here. The formations exposed show neither favorable structure nor contain sufficient organic material to form any noticeable quantities of petroleum. The chief encouragement to drill for oil in the western part of San Diego is stated to be the frequent occurrence on the beaches of masses of asphaltic residue.

During the years 1924 and 1925 there has been some renewal of interest in the development of oil in the county, and a number of companies have been organized to drill for oil. Development at the present time consists of four wells being drilled by various companies, but as

vet no oil indications have been encountered.

These wells are as follows:

L. Overpaugh and Rufus Choate in Sec. 11, T. 17 S., R. 2 W., S. B. M.

Todd and Clark in T. 18 S., R. 1 W.

National City Oil Co., Sec. 22, T. 18 S., R. 2 W., S. B. M.

Mission Valley Oil Enterprises, Sec. 24, T. 16 S., R. 3 W., S. B. M. On July 6, 1925, this well had been drilled to 5323 feet.

Bibl: State Mining Bureau Bulletin No. 89, Petroleum Resources of California, pp. 145–148; Bull. 69, pp. 467–468; State Mineralogist's Reports XIV, pp. 708–713; XVII, pp. 381–382.

#### MINERAL SPRINGS.

A number of mineral springs have long been known in this county, some of which have a high reputation as curative agents. For some years the annual production and sale of bottled water has been considerable. The principal springs are here enumerated:

Borrego Springs is located in Sec. 17, T. 11 S., R. 7 E., S. B. M., on the west bank of the broad Barrego Wash, on the western side of the Colorado Desert. It is about 33 miles by road northeast of Julian. The water of this spring, although somewhat alkaline, is entirely usable. Mesquite trees grow near the spring and in the valley, and salt grass, willow, and rushes are abundant. An old cabin stands on the bank about 50 feet from the spring and serves to mark its position.

Bradley Spring is situated six miles northward from the railroad station at Foster, 1775 feet in elevation. The water issues at the base of a granitic boulder in a steep ravine, where it is collected in a cemented reservoir, which is piped to a storage tank at the roadside. This is sent to San Diego and bottled as table water.

Buckman Springs, J. S. Hayden, owner, are about 60 miles east of San Diego in Sec. 20, T. 16 S., R. 5 E., Post Office, Campo. This group consists of six small carbonated springs, 3400 feet in elevation, with water at a temperature of 60–65° F. Approximate yield is five gallons per minute. The water is bottled, charged with natural carbonic gas and shipped in large quantities. An analysis by Smith, Emery & Co. follows:

	Grains
pe	r U. S. gal.
Silica (SiO ₂ )	5.55
Alumina (Al ₂ O ₃ )	0.43
Iron bicarbonate $(Fe(HCO_3)_2)_{}$	2.45
Calcium bicarbonate (Ca(HCO ₃ ) ₂ )	61.90
Magnesium bicarbonate (Mg(HCO ₃ ) ₂ )	10.18
Magnesium sulphate (MgSo ₄ )	4.75
Calcium sulphate (CaSo ₄ )	0.86
Magnesium chloride (MgCl ₂ )	2.09
Manganese perchloride (MnCl ₄ )	Trace
Potassium chloride (KCl)	1.21
Lithium chloride (LiCl)	
Sodium chloride (NaCl)	
Sodium nitrate (NaNO ₂ )	
Sodium bicarbonate (NaHCO ₃ )	6.03
Total solids per gallon	158.03

El Granito Mineral Springs are about one mile southeast of El Cajon, in 70 acres of the El Cajon Grant, described as the SW¹/₄ of the SW¹/₄ and E¹/₂ of the NW¹/₄ of SW¹/₄ of Sec. 14, T. 16 S., R. 1 W. Owner, El Bonito Springs Bottling Company, 1436 Market Street, San Diego.

This water was from earliest times greatly valued by the Indians for its curative properties in regulating the digestive functions. The spring is 500 feet in elevation, has a temperature of 62° F., and has an approximate yield of three gallons per minute.

#### Analusis.

By Joseph Luce, Salt Lake City.	Grains r U. S. gal.
Sodium chloride	2.448
Potassium carbonate	6.810
Sodium bicarbonate	14.164
Sodium carbonate	7.390
Potassium sulphate	.168
Magnesium sulphate	16.873
Aluminum oxide	.540
Calcium oxide	.392
Iron oxide	Trace
Silicium oxide	.927
Carbonic acid (free)	2.216
Organic matter	Trace
Total	51.928

The property is equipped with a bottling plant in operation since 1913.

Jacumba Hot Springs are about 24 miles east of Campo, on the line between Secs. 7 and 8, T. 18 S., R. 8 E., and about one-fourth mile north of Monument No. 233 of the international boundary, at an elevation of 2825 feet. They are all on the west side of the long valley of Carrizo Creek, whose outlet is to the northeast, through a deep narrow gorge, of which the greater part, including its head, is in Mexico. The springs include one of cold water, and several that yield waters with temperature ranging from 86° to 98° F. Total yield is about 15 gallons per minute. These thermal waters are regarded as medicinal, and a bath house and other accommodations are provided for travelers and pleasure seekers. Owner, B. L. Vaughn of Jacumba.

Nuvida Mineral Spring is about ten miles east of San Diego and was formerly known as Isham's Spring. It is located in the Jamacha Grant, north of the Sweetwater Reservoir.

$\operatorname{Gr}$	rains
Analysis. per U.	.S. gal.
Sodium chloride1	16.32
Potassium chloride	1.98
Magnesium chloride 1	0.10
Calcium chloride	2.93
Calcium carbonate1	1.19
Magnesium sulphate	3.48
Iron peroxide	.03
Manganese carbonate	.17
Silica	3.09
Alumina	.09
——————————————————————————————————————	
Total solids per gallon4	.9.75

Warner's Hot Springs, long known to the natives as Las Aguas Calientes, consists of six springs situated at the northeastern margin of the old grant known as San Jose del Valle, and by county highway are about 67.6 miles from San Diego. These springs are 3150 feet in elevation and discharge into a ravine in the Palomares Mountains about 150 gallons a minute of water having a temperature of from 131–139° F. Owners are Guy K. Woodward and Ralph Jasper, who conduct a hotel and sanitarium on the property. The post office is known as Warner Springs.

Analysi	Grains per U. S. gal.
Sodium sulphate	5.65
Sodium sulphide	
Silica	
Sodium silicate	
Sodium carbonate	0
Sodium	9.90
Potassium sulphate	
Calcium silicate	
Calcium phosphate	0.11
Ammonium	0.09
Magnesium sulphate	0,09
Sodium biborate	
Ferric oxide	0.04
Lithium	Trace
Strontium	Trace
Magnesium oxide	Trace

Bibl: State Mineralogist's Report XIV, pp. 717–722; U. S. Geol. Survey Water Supply Paper 338, 'Springs of California', U. S. Geol. Surv. Water Supply Paper No. 224, pp. 84–87.

# OIL FIELD DEVELOPMENT OPERATIONS.

By R. D. Bush, State Oil and Gas Supervisor.

From April 12, 1925, to and including July 18, 1925, the following new wells were reported as ready to drill:

Company	Sec.	Twp.	Range	Well No.	Field
COLUSA COUNTY:					
S. H. Keoughan, trustee	31	18	4	1-A	Colusa County
FRESNO COUNTY:					
Pacific Oil Co.	7 13	20 20	15 14	16 34	Coalinga Coalinga
Pacific Oil Co.	25	20	14	66	Coalinga
Pacific Oil Co. Paragon Oil Co.	25 17	20 19	14 15	68 17	Coalinga
Penn Coalinga Petroleum Co.	1	20	14	15	Coalinga Coalinga Coalinga
Zier Oil Co	1 1	20 20	14 14	1-N 2-N	Coalinga Coalinga
Zier Oil Co.	1	20	14	3-N	Coalinga
Associated Oil Co.	35 14	13 15	16 18	1 1	Fresno County
Zier Oil Co Associated Oil Co Associated Oil Co Associated Oil Co	15	16	19	î	Fresno County Fresno County Fresno County
KERN COUNTY:					
C. G. Cragin & V. E. Sack	29	25	19	1	Devils Den
Pacific Oil Co.	26 27	30 30	24 24	$\begin{array}{c} 1 \\ 24 \end{array}$	Elk Hills Elk Hills
Pan American Petroleum Co.	1	31	24	Crampton 5-I	Elk Hills
Standard Oil Co.	31	30	25	Kern Co. Lease 1 23	Elk Hills
Standard Oil Co.	31	30	25	Kern Co. Lease 1 24	Elk Hills
Standard Oil Co Union Oil Co	36 26	30	24 24	Tupman 44 Elk Hills 11	Elk Hills Elk Hills
Boston Petroleum Co George F. Getty, Inc George F. Getty, Inc George F. Getty, Inc	20	28	28	24	Kern River Kern River
George F. Getty, Inc.	28 32	27 27	27 27	Dale 1 Grimes 1	Kern River Kern River
George F. Getty, Inc.	22	28	27	Tegeler 1	Kern River
Loscal Petroleum Co Petroleum Securities Co	21	28 28	28 27	17	Kern River Kern River
Revenue Oil Co	4	29	28	23	Kern River
Standard Oil CoStandard Oil Co	21 15	28 28	27 27	2 4	Kern River Kern River
		29	28	8	Kern River
J. C. Theriot	23	29 29	27 28	1 4-A	Kern River
F. G. Wagner	34	28	28	1	Kern River Kern River
Universal Consolidated Oil Co Universal Consolidated Oil Co	30 32	26 26	21 21	14 45	Lost Hills Lost Hills
Barnsdall Oil Co	30	29	22	21	McKittrick
Cyril C. Lovitt Smith & McRae Standard Oil Co.	10	30 30	21 22	1	McKittrick McKittrick
Standard Oil Co.	25	29	21	Weston 3	McKittrick
Bell-Evans Oil Co., Inc. Bell-Evans Oil Co., Inc.	35 35	32 32	23 23	8 and 9	Midway Midway
		32	23	13	Midway
Berry & Ewing	6 31	31 32	23 24	$\frac{1}{4}$	Midway Midway
Big Ten Oil Co.	36	32	23 23	10 20	Midway
H. H. Bell— Berry & Ewing— Big Ten Oil Co. Big Ten Oil Co. E. & M. Oil Co.	36	32	23	13	Midway Midway
E. & M. On Co	10	31	22 23	Sue Greenleaf 1	Midway
Elbe Oil Land Development Co Federal Drilling Co	20	31	24	2	Midway Midway
Federal Drilling Co. Federal Drilling Co. Federal Drilling Co.	20 20	31 31	24 24	3 11	Midway Midway
Formax Oil Co.	36	32	23	19	Midway
Formax Oil Co.	36	32 32	23 23	20 21	Midway Midway
Formax Oil Co. General Petroleum Corp.	32	31	24	Buena Vista 11	Midway
Gilmore Oil Co	27	31 31	22 22	2 3	Midway Midway
Honolulu Concolidated Oil Co	1	32	24	13	Midway
Honolulu Consolidated Oil Co Honolulu Consolidated Oil Co Honolulu Consolidated Oil Co	6	32 32	24 24	14 23	Midway Midway
Honolulu Consolidated Oil Co.	4	32	24	32	Midway
Honolulu Consolidated Oil Co.	6	32 32	24 24	34 54	Midway Midway
Honolulu Consolidated Oil Co.	4	32	24	62	Midway
Honolulu Consolidated Oil Co. Honolulu Consolidated Oil Co. Honolulu Consolidated Oil Co. Honolulu Consolidated Oil Co.	4 4	32 32	24 24	73 83	Midway Midway
Honolulu Consolidated Oil Co.	6	32	24	89	Midway

# OIL FIELD DEVELOPMENT OPERATIONS—Continued.

Company	Sec.	Twp.	Range	Well No.	Field
KERN COUNTY—Continued.					
Manley & McGinn	1.5	91	99	19	Midwey
Manley & McGinn	15 15	31	22 22	13 16	Midway Midway
Massat Oil Co	26	32	23	55	Midway
Midland Oilfields Co., Ltd.	34	31	24	Thornber 5	Midway
Gus Ninkovich.	6	31	23	1	Midway
North American Oil Cons.	32	31	24	4	Midway
North American Oil Cons.	30	31	24	21	Midway
North American Oil Cons.	30 30	31	24 24	22 23	Midway
North American Oil Cons North American Oil Cons	30	31	24	24	Midway Midway
North American Oil Cons.	30	31	24	28	Midway
Pacific Oil Co.	29	31	24	1	Midway
Pacific Oil Co.	29	31	24	8	Midway
Pacific Oil Co.	33	31	24	10	Midway
Pacific Oil Co.	19	31	24	13	Midway
Pacific Oil Co.	19 19	31	24 24	15 16	Midway Midway
Pacific Oil Co.	19	31	24	17	Midway
Pacific Oil Co.	19	31	24	19	Midway
Pacific Oil Co.	33	31	24	19	Midway
Pacific Oil Co.	19	31	24	21	Midway
Pacific Oil Co.	19	31	24	22	Midway
Pacific Oil Co.	31	31	24	31	Midway
Pacific Oil Co.	29 29	31	24	40 47	Midway
Pacific Oil Co.	33	31	24 24	56	Midway Midway
Pacific Oil Co.	34	32	24	Dorothy 2	Midway
Petroleum Midway Co., Ltd. Petroleum Midway Co., Ltd.	34	32	24	Dorothy 3	Midway
John F. Philippi	4	32	23	1	Midway
Southwestern Petroleum Co	2	31	22	7	Midway
Union Oil Co.	36	30	22	Mason 1	Midway
Valley Oil Co.	14	31	22	2	Midway Sunset
Atlas Oil Co.	$\frac{30}{34}$	12 12	23 24	A-1 Hillside 15	Sunset
C. J. Berry Big Chief Oil Co.	2	11	24	6	Sunset
Big Ten Oil Co.	36	32	23	15	Sunset
Calitroleum Oil & Gas Co.	4	11	23	4	Sunset
Lewis Petroleum Co.	$3\overline{4}$	12	24	G-M 11	Sunset
Midway Oil Co	35	12	24	379	Sunset
Midway Oil Co.	35	12	24	376-B	Sunset
Standard Oil Co.	2	11	24	Monarch 44	Sunset
Standard Oil Co.	10 34	11 12	23 24	Rass 2 25	Sunset Sunset
Tannehill Oil Co	12	29	20	23	Temblor
Hall & Baker	1	29	20	ĩ	Temblor
T. G. Hutt	30	29	21	How 1	Temblor
L. E. Westrich	24	29	20	1	Temblor
Standard Oil Co.	27	11	20	Kern Co.	
	o lut			Lease 2 19	Wheeler Ridge
Standard Oil Co	27	11	20	Kern Co. Lease 2 20	Whasler Didge
Polyidge Oil Co	32	32	23	Lease 2 20 Gonyer 1	Wheeler Ridge Kern County
Belridge Oil Co Fremont Oil Corp.	22	31	38	2	Kern County
Glide Petroleum Co.	11	27	28	ĩ	Kern County
Glide Petroleum Co	11	27	28	2 3	Kern County
Glide Petroleum Co.	11	27	28		Kern County
Glide Petroleum Co.	11	27	28	4	Kern County
Matie G. Jones Pyramid Oil Co.	6	11	22	1	Kern County
Pyramid Oil Co.	20	32 27	25 18	. 1	Kern County Kern County
Smoot Oil Co Standard Oil Co	1 36	26	18	Lazard 1	Kern County
Standard Oil Co.	15	28	22	Miller & Lux	LICIAN COUNTY
	_0			Option 1	Kern County
Standard Oil Co	12	25	19	S. F. and Fresno	
				Land Co. 1	Kern County
World Oil Co.	12	11	9	1	Kern County
KINGS COUNTY:					
	00	0.2	10	1	Kings County
Louis D. Fay	28	23	19	1	1111gs County
LOS ANGELES COUNTY:					
Shell Co.	34	2	13	Manuel 6	Dominguez
Shell Co.	34	3	13	Reyes 27	Dominguez
Shell Co.	34	3	13	Reyes 27-A	Dominguez
Shell Co	33	3	13	Reyes 29	Dominguez
Union Oil Co.	33	3	13	Hellman 12	Dominguez
Union Oil Co. Associated Oil Co.	7 7	2	14	Vickers 3	Inglewood
Associated Oil Co	7	3 3 3 3 2 2 2 2 2 2	14	Vickers 4	Inglewood
Associated Oil Co.	7	2	14	Vickers 6	Inglewood
Associated Oil Co.	7	2	14	Vickers 7	Inglewood

# OIL FIELD DEVELOPMENT OPERATIONS—Continued.

			1		
Company	Sec.	Twp.	Range	Well No.	Field
LOS ANGELES COUNTY—Cont.					
Associated Oil Co	7	2	14	Vickers 10	Inglewood
Associated Oil Co	7	2	14	Vickers 11	Inglewood
Associated Oil Co	7	2	14	Vickers 12	Inglewood
Associated Oil Co	777777777777777777	222222222222222222222222222222222222222	14	Vickers 13	Inglewood
Associated Oil Co.	7	2	14	Vickers 14	Inglewood
Associated Oil Co.	7	2	14	Vickers 17	Inglewood
Associated Oil Co	7	2	14 14	Vickers 18 Vickers 20	Inglewood Inglewood
Associated Oil Co.	7	2	14	Vickers 22	Inglewood
Associated Oil Co.	7	2	14	Vickers 24	Inglewood
Associated Oil Co.	7	2	14	Vickers 25	Inglewood
Associated Oil Co.	7	2	14	Vickers 27	Inglewood
Associated Oil Co	7	2	14	Vickers 29	Inglewood
Associated Oil Co.	7	2	14	Vickers 32	Inglewood
Associated Oil Co.	7	2	14 14	Vickers 34	Inglewood Inglewood
Brownmoor Oil Co	8	2	14	2	Inglewood
Brownmoor Oil Co.	8	2	14	2 3	Inglewood
Brownmoor Oil Co.	8 7 7 8 8 7 7 7 7 8	2	14	5	Inglewood
Brownmoor Oil Co.	7	2	14	6	Inglewood
Brown Shasta Oil Co.	8	2	14	1	Inglewood
Brown Shasta Oil Co.	8	2	14	2 3	Inglewood
Brown Shasta Oil Co.	7	2	14		Inglewood
Brown Shasta Oil Co.	7	2	14	4	Inglewood
Brown Shasta Oil Co	7	2	14	5 7	Inglewood Inglewood
The 57 Petroleum Corp.	8	2	14 14	Moynier 1	Inglewood
Mohawk Oil & Gas Syn.	7	2	14	With 1	Inglewood
Pacific Oil Co.	17	2	14	Baldwin 11	Inglewood
Pacific Oil Co.	8	2	14	Baldwin 17	Inglewood
Pacific Oil Co.	17	2	14	Baldwin 21	Inglewood
Petroleum Midway Co., Ltd.	8	2	14	Moynier 4	Inglewood
Petroleum Midway Co., Ltd.	8	2	14	Moynier 5	Inglewood
Petroleum Midway Co., Ltd.	8	2	14	Moynier 7	Inglewood
Petroleum Midway Co., Ltd. Petroleum Securities Co.	8 7 7 7	2	14	Moynier 7 Moynier Twin 1 Smith 4	Inglewood . Inglewood
Petroleum Midway Co., Ltd.	4	2	14	Smith 4 Smith 6	Inglewood
Petroleum Securities Co	8	2	14	Cone 5	Inglewood
Petroleum Securities Co.	8	2	14	Cone 7	Inglewood
Petroleum Securities Co.	8 8 8	2	14	Cone 8	Inglewood
Petroleum Securities Co.	8	2	14	Cone 9	Inglewood
Petroleum Securities Co	8	2	14	Cone 10	Inglewood
Petroleum Securities Co.	8	2	14	Cone 11	Inglewood
Petroleum Securities Co.	8	2	14	Cone 12	Inglewood
Petroleum Securities Co Petroleum Securities Co	8	2	14 14	Cone 13 Lloyd 2	Inglewood Inglewood
Petroleum Securities Co.	8	2	14	Lloyd 3	Inglewood
Petroleum Securities Co.	8	2	14	Lloyd 4	Inglewood
Petroleum Securities Co.	8 8	2	14	Lloyd 5	Inglewood
Petroleum Securities Co.	\$ 2 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	2	14	Lloyd 6	Inglewood
Petroleum Securities Co	2	2	15	Palm Crest 1	Inglewood
Petroleum Securities Co.	8	2	14	Rubel 1, 2, 3, 4, 5	Inglewood
Petroleum Securities Co Petroleum Securities Co	8	2	14	Rubel 6	Inglewood
Petroleum Securities Co.	9.	2	14	Rubel 7 Rubel 8	Inglewood Inglewood
Petroleum Securities Co.	8	2	14	Rubel 9	Inglewood
Petroleum Securities Co.	8	2	14	Rubel 11	Inglewood
Petroleum Securities Co.	8	2	14	Rubel 12	Inglewood
Petroleum Securities Co	8	2	14	Rubel 13	Inglewood
Petroleum Securities Co.	8	2	14	Rubel 14	Inglewood
Petroleum Securities Co.	8	2	14	Rubel 15	Inglewood
Shell Co.	8	2	14	Rindge 2	Inglewood
Shell Co. Shell Co.	8	2	14	Rindge 3 Rindge 4	Inglewood Inglewood
Shell Co.	8	2	14 14	Rindge 4 Rindge 5	Inglewood
Shell Co.	8	2	14	Rindge 6	Inglewood
Shell Co.	8	2	14	Rindge 7	Inglewood
Shell Co.		0	14	Rindge 8	Inglewood
Shell Co.	8	2	14	Tunage 5	Inglewood
Shell Co.	8	2	14	Rindge 10	Inglewood
Shell Co.	8	2	14	Rindge 11	Inglewood
Shell Co.	8	2	14	Rindge 12 Rindge 13	Inglewood Inglewood
Standard Oil Co.	17	2	14 14	L.A.Invest. 1 7	Inglewood
Standard Oil Co.	8	2	14	L.A.Invest. 1 8	Inglewood
Standard Oil Co.	8	2	14	L.A.Invest. 1 9	Inglewood
Shell Co. Shell Co. Standard Oil Co.	8	2	14	L.A.Invest. 1 10	Inglewood
Standard On Co	888888888888888888888888888888888888888	222222222222222222222222222222222222222	14	L.A.Invest. 1 11	Inglewood
Standard Oil Co.	8	2	14	L.A.Invest. 1 12	Inglewood
Standard Oil Co.	8	2	14	L.A.Invest. 1 13	Inglewood

#### OIL FIELD DEVELOPMENT OPERATIONS-Continued.

Company	Sec.	Twp.	Range	Well No.	Field
LOS ANGELES COUNTY—Cont.					
Standard Oil Co. Standard Oil Co. Standard Oil Co.	17 8 8	2 2 2 2	14 14 14	L.A.Invest. 1 14 L.A.Invest. 1 15 L.A.Invest. 1 16	Inglewood Inglewood Inglewood
Standard Oil Co.	8	2	14	L.A.Invest. 1 17	Inglewood
Standard Oil Co.	8	2 2 2 2	14 14	L.A.Invest. 1 18 L.A.Invest. 1 19	Inglewood Inglewood
Standard Oil Co.	8 17	2	14	L.A.Invest, 1 20	Inglewood Inglewood
Standard Oil Co Standard Oil Co	8 8 17	2	14 14	L.A.Invest. 1 21 L.A.Invest. 1 22	Inglewood Inglewood
Standard Oil Co. Standard Oil Co. Standard Oil Co.	17	2	14	L.A.Invest. 1 23 L.A.Invest. 2 3	Inglewood Inglewood
Standard Oil Co	17 17	2	14 14	L.A.Invest. 2 4	Inglewood
Standard Oil Co. Standard Oil Co. Standard Oil Co.	17	2 2 2 2 2 2 2	14 14	L.A.Invest. 2 5 Vickers 1 5	Inglewood Inglewood
Standard Oil Co.	7 8	2	14	Vickers 1 6	Inglewood
Standard Oil Co.	8	2 2	14 14	Vickers 1 7 Vickers 1 8	Inglewood Inglewood
Standard Oil Co. Standard Oil Co. Standard Oil Co.	8 7 7 8 8 8 8	2 2 2 2	14	Vickers 1 9	Inglewood Inglewood
Standard Oil Co.	8	2 2	14 14	Vickers 1 10 Vickers 1 11	Inglewood
Standard Oil Co.	8	2	14 14	Vickers 1 12 Vickers 1 13	Inglewood Inglewood
Standard Oil Co	8	2 2 2 2	14	Vickers 1 14	Inglewood
Standard Oil Co Standard Oil Co	8 7	2	14 14	Vickers 1 15 Vickers 2 4	Inglewood Inglewood
Standard Oil Co. Standard Oil Co.	8 7 7 7	$\begin{bmatrix} 2\\2\\2\\2\\2 \end{bmatrix}$	14	Vickers 2 5	Inglewood
Standard Oil Co.	7	$\begin{vmatrix} 2\\2 \end{vmatrix}$	14 14	Vickers 2 6 Vickers 2 7	Inglewood Inglewood
Standard Oil Co.	7 24	$\frac{1}{2}$	14 13	Vickers 3 1	Inglewood
I. W. Bailes				Whiston & Kackley 1	Long Beach
N. Braly and N. T. Slade Bush-Voorhis Oil Co	24 19	4 4	13 12	Engelke 1 13	Long Beach Long Beach
Center Oil Co	19	4	12	1	Long Beach Long Beach
Cook Oil Corp Craig, Burns & Co., Inc	24 19	4	13 12	Reese-Benedict 1	Long Beach
Craig, Burns & Co., Inc.	19	4	12	Reese- Benedict 1-A	Long Beach
Craig, Burns & Co., Inc.	13	4	13	Scott-Mogle 1	Long Beach
Harry Failing General Petroleum Corp	19 19	4 4	12 12	Finney 1 K. & H. 6	Long Beach Long Beach
A. T. Jergins Trust	19	4	1 12	17	Long Beach Long Beach
A. R. Johnson	24 24	4 4	13 13	1	Long Beach
Lindauer Oil Co.	24 24	4 4	13 13	1	Long Beach Long Beach
General Petroleum Corp. A. T. Jergins Trust A. R. Johnson A. T. Kenney Lindauer Oil Co. Linden Oil Co. O. F. W. Drilling Co., Inc. J. E. O'Donnell LE O'Donnell	24	4	13	1	Long Beach
J. E. O'Donnell J. E. O'Donnell	19 19	4 4	12 12	O'Donnell 39 O'Donnell 40	Long Beach Long Beach
J. E. O'Donnell	24	4	13	O'Donnell 41	Long Beach
J. E. O'Donnell Painted Hills Oil Assn	24 13	$\frac{4}{4}$	13 13	O'Donnell 43 8	Long Beach Long Beach
Pan American Petroleum Co.	19	4	12 12	U. P. 7	Long Beach Long Beach
Pan American Petroleum Co Petroleum Midway Co., Ltd	19 19	4 4	12	U. P. 7 U. P. 8 Fields 15	Long Beach
Petroleum Midway Co., Ltd	19 28	4 4	12 12	Fields 16 R. L. M. 1	Long Beach Long Beach
W. R. Ramsey. San Martinez Oil Co South Slope Oil Co J. P. Spaulding	29	4	12 13	Booth Comm.4-A O'Donnell 42	Long Beach
J. P. Spaulding	13 13	4 4	13	O'Donnell 42 Probasco 1	Long Beach Long Beach
Umpire Petroleum Corp.	24	4	13	2	Long Beach Long Beach
J. P. Spaulding Umpire Petroleum Corp. The United Oil Co. Fred A. Walker Weaver Bros.	13 24	4 4	13 13	Bixby 2-A	Long Beach
Weaver Bros. McGinley Oil Co.	24	4	13 11	1 17	Long Beach Montebello
St. Helens Petroleum Co., Ltd St. Helens Riverside Properties	2	2	12	Mulholland 2	Montebello
St. Helens Riverside Properties Associated Oil Co	20	2 3	12 13	Monterey 9 Higgins 3	Montebello Rosecrans
Barnadall Oil Co	19	2 2 2 3 3 3 2	13	O'Dea 5	Rosecrans
Barnsdall Oil Co. Burnham Exploration Co. P. L. Cooper	20 35	3 2	13 14	Rosecrans 6 Wagner 2	Rosecrans Rosecrans
P. L. Cooper- DeLendrecie Oil Well DeLendrecie Oil Well	7 7 7	3	13 13	Athens 2	Rosecrans Rosecrans
DeLendrecie Oil Well  Elbe Oil Land Development Co	7	3	13	Athens 2-A	Rosecrans
Elbe Oil Land Development Co	20	3	13 13	5 12	Rosecrans Rosecrans
Walter H. Fisher Corp. Walter H. Fisher Corp.	7 7 7 7	3 3 3 3 3 3 3	13	14	Rosecrans
Fullerton Oil Co Wm. E. Garner	7	3	13 13	Athens 1 Garner 2	Rosecrans Rosecrans

# OIL FIELD DEVELOPMENT OPERATIONS—Continued.

Company	Sec.	Twp.	Range	Well No.	Field
LOS ANGELES COUNTY—Cont.					
	7	3	13	Athens 7	Rosecrans
George F. Getty, Inc.	777777777777777777777777777777777777777	3	13	Athens 8	Rosecrans
C. P. Harrell	7	3 3 3	13	1	Rosecrans
Henderson Petroleum Corp.	7	3	13	Athens 4	Rosecrans
Hitchcock & Ort	7	3 3 3 3 3 3 3 3 3 3 3	13	H. & O. 12 H. & O. 11	Rosecrans
Hitchcock & Ort. Julian Petroleum Corp.	7	3	13 13	Athens 4	Rosecrans Rosecrans
Julian Petroleum Corp.	7	3	13	Athens 5	Rosecrans
Julian Petroleum Corp.	7	3	13	Athens 6	Rosecrans
Julian Petroleum Corp.	7	3	13	Athens 7	Rosecrans
Julian Petroleum Corp.	7	3	13	Athens 8	Rosecrans
Julian Petroleum Corp. Julian Petroleum Corp. Julian Petroleum Corp.	7	3	13	Athens 9	Rosecrans
Julian Petroleum Corp.	7	3	13 13	Athens 12 Athens 13	Rosecrans Rosecrans
M ( Xr N	18	3	13	Athens 15	Rosecrans
Marine Corp. Marine Corp. Marine Corp.	20	3	13	36	Rosecrans
Marine Corp.	7 7	3 3 3	13	37	Rosecrans
Marine Corp.	7	3	13	38	Rosecrans
Marine Corp.	20	3	13	41	Rosecrans
McBride-Bremner	7	3	13	McBride 1	Rosecrans
Pacific Petroleum Corp. & The United Oil Co.	7	3	13	Athens 4	Rosecrans
Petroleum Midway Co Ltd	20	3	13	Colby 2	Rosecrans
Petroleum Midway Co., Ltd. Petroleum Midway Co., Ltd. Petroleum Midway Co., Ltd. J. T. Robertson Co.		3	13	Kreitz Comm. 2	Rosecrans
Petroleum Midway Co., Ltd	7	3 3 3	13	Kreitz Comm. 3	Rosecrans
J. T. Robertson Co.	7	3	13	2	Rosecrans
	7 7 7 7	3 3 3	13	Athens 5	Rosecrans
Sentinel Oil Co. Sentinel Oil Co. St. Helens Petroleum Co., Ltd.		3	13	Athens 6	Rosecrans
Star Petroleum Co.	20 20	3	13 13	Walsh 1 Ballsun 1	Rosecrans Rosecrans
Superior Oil Co.	20	3	13	Maxwell	Rosecians
Superior Oil Co.	20	3	13	Comm. 5 Maxwell	Rosecrans
Superior On Co	20	9	19	Comm. 8	Rosecrans
Superior Oil Co	20	3	13	Weaver 1	Rosecrans
Union Oil Co	18	3	13	Howard Park 22	Rosecrans
Union Oil Co	18	3	13	Howard Park 23	Rosecrans
Union Oil Co.	18	3	13	Howard Park 24	Rosecrans
Union Oil Co C. C. M. O. Co C. C. M. O. Co C. C. M. O. Co	17	3 4	13	Padelford 2	Rosecrans
C. C. M. O. Co.	9	4	14 14	Del Amo 27 Del Amo 34	Torrance Torrance
C. C. M. O. Co.	16	4	14	Del Amo 37	Torrance
C. C. M. O. Co	9	4	14	Del Amo 69	Torrance
C. C. M. O. Co.	8	4	14	Del Amo 75 Del Amo 81	Torrance
C. C.*M. O. Co C. C. M. O. Co	8	4	14	Del Amo 81	Torrance
C. C. M. O. Co.	8 8 9	4	14 14	Del Amo 103	Torrance
C. C. M. O. Co.	o o	4 4	14	Del Amo 104 Del Amo 105	Torrance Torrance
C. C. M. O. Co.	9	4	14	Del Amo 106	Torrance
	15	4	14	Torrance 75	Torrance
C. C. M. O. Co.	10	4	14	Torrance 88	Torrance
General Petroleum Corp.	8	4	14	Carson 9	Torrance
General Petroleum Corp.	8	4	14	Carson 10	Torrance
George F. Getty, Inc.	8	4 4	14 14	Torrance 26 Torrance 27	Torrance Torrance
Marine Corp.	25	4	14	52	Torrance
Marine Corp Petroleum Midway Co., Ltd	5	4	14	Redondo Imp.	101141100
				Co. 3	Torrance
Shell Co.	9	4	14	Frenger 4	Torrance
Shell Co	9	4	14	Frenger 5	Torrance
Shell Co. Standard Oil Co.	13	4 4	14 14	Torrance 4 Dominguez 13	Torrance Torrance
Standard Oil Co.	22	4	14	Marble Lease 24	Torrance .
Superior Oil Co.	19	4	13	Torrance 36	Torrance
Standard Oil Co. Superior Oil Co. Superior Oil Co.	30	4	13	Torrance 62	Torrance
Petroleum Midway Co., Ltd	17	2	11	Seward-	
	10		10	Rideout 2	Whittier
Bandini Petroleum Corp.	16	2 2	12 12	DeBaker 4	Los Angeles County
Oak Ridge Oil Co	22 15	2 2	12	Couts Comm. 1 Vail 1	Los Angeles County Los Angeles County
	10		12	7.011 1	
MERCED COUNTY					
Henry L. Kuns	9	12	9	1	Merced County
				Î	
NAPA COUNTY—					
Griffiths Oil Co	7	8	3	6	Napa County
Cirmons On Co	4	, 9	1 10	0	Trapa County

# OIL FIELD DEVELOPMENT OPERATIONS—Continued.

Company	Sec.	Twp.	Range	Well No.	Field
ORANGE COUNTY— C. C. M. O. Co Union Oil Co Union Oil Co	9 10 13	3 3 3	9 9 10	97 Olinda 2 Graham &	Brea Olinda Brea Olinda
Pan American Petroleum Co Petroleum Midway Co., Ltd Petroleum Midway Co., Ltd Retsof Drilling Co Standard Oil Co	11 11 2 2 34	6 6 6 6 5	11 11 11 11 11	Loftus 56-A Johnson 4 Brown 7 Elliott 4 74 Bolsa 21	Coyote Hills Huntington Beach Huntington Beach Huntington Beach Huntington Beach Huntington Beach
Standard Oil Co. Standard Oil Co. Standard Oil Co. Standard Oil Co.	34 3 2 27	5 6 6 5	11 11 11 11 10	Huntington A 29 Huntington A 29 Huntington B 35 Santa Ana Gardens 1	Huntington Beach Huntington Beach Huntington Beach Huntington Beach
Sun Oil Co. Beesemyer & Yerkes Beesemyer & Yerkes A. T. Jergins Trust Jesse M. Nelson Co. Barnett Rosenburg Barnett Rosenburg	17	6 6 6 6 6 6	11 10 10 10 10 10 10	Elmer 2 Orange Co. 3 1 1 1 Fairview Farms 1	Huntington Beach Newport Newport Newport Newport Newport Newport Newport
Warrington & DeKay F. A. Winchester Chiksan Oil Co. Petroleum Midway Co., Ltd.	28 23	6 6 3 3	10 10 9 9	Richfield Consolidated 10	Newport Newport Richfield Richfield
Hoyt S. Gale	31	5	9	Irvine 1	Orange County
RIVERSIDE COUNTY— Trabuca Oil Co	28	4	6	1	Riverside County
SAN BERNARDINO COUNTY— Hesperia Oil & Gas Co	29	4	4	1-A	San Bernardino Co.
SAN JOAQUIN COUNTY—	20				
Pacific Petroleum Producers	12	4	7	1	San Joaquin County
SAN LUIS OBISPO COUNTY— Barneberg Oil Co	$\bar{2}\bar{7}$	32 32	15 12	1	San Luis Obispo Co. San Luis Obispo Co.
SAN MATEO COUNTY— Rollo Ellis— La Honda Oil Fields Assn.————	21	7 7	4 4	1 3	San Mateo County San Mateo County
SANTA BARBARA COUNTY— Pan American Petroleum Co	32	9 9	34 32 32	Soladino 15 Williams 1 Stendell 5	Casmalia Cat Canyon Cat Canyon
R. & G. Oil Co. Rice Ranch Oil Co. G. F. Becker. James F. Nugent Oil Co.	30	9 9	32 34 ummer 25	Radium 3	Cat Canyon Santa Maria Santa Barbara Co. Santa Barbara Co.
SANTA CRUZ COUNTY— Swanton Improvement Co		11	2	1	Santa Cruz Co.
TULARE COUNTY—  Dinuba Oil & Petroleum Co  Hub Oil Co  Pioneer Development Co	Lot 1 c 26 17	f Orr S 22 22	ubdivi 27 27	sion, Dinuba 1 Halbert 1 2	Tulare County Tulare County Tulare County
VENTURA COUNTY—  Montebello Oil Co C. A. Harding, Trustee		3 2 2 2 2 2 2 2 2 2 2	19 20 20 20 20 20 20 20 20 20 20	Shiells 118 10 11 12 13 44 45 46	Bardsdale Conejo Conejo Conejo Conejo Conejo Conejo Conejo

# OIL FIELD DEVELOPMENT OPERATIONS.

# OIL FIELD DEVELOPMENT OPERATIONS—Concluded.

Company	Sec.	Twp.	Range	Well No.	Field
Company  J. A. Hess. J. A. Hess. J. A. Hess. Rio Virgin Oil Syn. Rio Virgin Oil Syn. Rio Virgin Oil Syn. Chalmers & Ford. Julian Petroleum Corp. Sehell & Jennings. Modoc Petroleum Corp. Oak Ridge Oil Co. Oak Ridge Oil Co. Ring Petroleum Corp. Santa Paula Oil Co. Associated Oil Co. Associated Oil Co.	4 4 4 4 4 14 13 22 20 13 18 22 18 27 27	Twp.  1 1 1 1 4 4 4 5 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	20 20 20 20 20 20 18 19 21 20 21 20 21 20 23 23	Well No.  4 5 6 6 2 3 4 1 1 6 8 2 Harvey 17 Willard 18 Santa Paula 17 Lloyd 21 Lloyd 21 Lloyd 21	Conejo Conejo Conejo Conejo Conejo Conejo Piru Piru Piru Sespe South Mountain South Mountain South Mountain South Mountain Ventura Ventura
Associated Oil Co. General Petroleum Corp. General Petroleum Corp. General Petroleum Corp.	28 28 28 28		23 23 23 23	Lloyd 31 Notten 7 Notten 8 Notten 9	Ventura Ventura Ventura Ventura
J. A. Hess J. A. Hess Shell Co. Shell Co.	34 4 28 28	4 3 3 3	23 23 23 23	1-A 18 Gosnell 10 Gosnell 16	Ventura Ventura Ventura Ventura
Shell Co. Shell Co.	28 28	3 3	23 23	Gosnell 17 Taylor 9	Ventura Ventura

## SPECIAL ARTICLES.

Detailed technical reports on special subjects, the result of research work or extended field investigations, will continue to be issued as separate bulletins by the Bureau, as has been the custom in the past.

Shorter and less elaborate technical papers and articles by members of the staff and others are published in each number of 'Mining in

California.'

It is anticipated that these special articles will cover a wide range of subjects both of historical and current interest; descriptions of new processes, or metallurgical and industrial plants, new mineral occurrences, and interesting geological formations, as well as articles intended to supply practical and timely information on the problems of the prospector and miner, such as the text of new laws and official regulations and notices affecting the mineral industry.

# DEALERS IN GOLD-SILVER ORES AND BULLION MUST TAKE OUT LICENSES.

Senate Bill No. 137, which was passed by the forty-sixth session of the legislature and approved by the Governor, April 15, 1925,

became effective July 24, 1925.

This bill is for the regulation and control and licensing of persons, firms or corporations engaged in the business of sampling, concentrating, purchasing or receiving for sale ores, concentrates or amalgams bearing gold and silver, gold dust, silver or gold bullion, nuggets or

specimens.

This act will make it necessary for any one dealing in the above mentioned materials to take out a license together with a bond, the license fee being \$100 per year and the bond \$3,000. The banks, while exempt from paying the license fee, will not be exempted from the provisions of the act and of the bond. Jewelers and pawnbrokers who turn in their sweepings and scrap as is and not melted will be exempted, but those dealing in ores, specimens, nuggets and melted materials will come under the provisions of the act. Others affected by this act are assayers, storekeepers, trustees, referees and others dealing in gold and silver ores, bullion, nuggets and amalgams.

Application blanks for licenses and copies of the law may be had by applying to Lloyd L. Root, State Mineralogist, State Mining Bureau,

Ferry Building, San Francisco.

An abstract of the law is as follows:

Section 1.—Provides that it shall be unlawful for any person, firm, association or corporation, without first procuring a license from the state mineralogist, to engage in the business indicated in the above mentioned title. The annual license fee is \$100 and will be issued only to bona fide residents of California, and to such corporations organized under the laws of other states as are duly qualified to do business in this state. *Provided, however*, that this act is not to be construed as requiring a license for any mill, sampler, concentration or reduction plant used exclusively by any company or owner in sampling, milling, reducing or concentrating ores produced by such owner.

Section 2.—Provides that the application for license must be made to the state mineralogist accompanied by certain information which must be sworn to by such applicant. Licenses will be granted only after 30 days notice and by publication at least once a week for three successive weeks, at the expense of applicant, in a newspaper published

in the county where such business is carried on.

Protests to the granting of licenses, and written charges for the revocation of licenses already issued, may be filed and public hearings held thereon in accordance with prescribed rules, and the state mineralogist shall have the power to reject an application or revoke any license for failure on the part of the applicant or licensee to observe this act or any law of the state relative to larceny or receiving stolen property. Application for a review or appeal to the Superior Court from any decision made by the state mineralogist is also provided for under the provisions of this section.

Section 3.—Provides that each application for a license shall be accompanied by a bond to the people of the State of California in the sum of \$3,000, and conditioned that the licensee shall not violate any law applicable to said business. Said bond will be subject to execution upon any judgment recovered against a licensee as the result of

his violation of any law relating to such business.

Section 4.—Provides that every person, firm, association or corporation engaged in such business shall keep and preserve a book in which shall be entered at the time of delivery of any ores, concentrates or amalgams, bearing gold or silver, gold dust, gold or silver bullion, nuggets or specimens:

First—The name of the party on whose behalf such ores, concentrates, gold dust, gold or silver bullion, nuggets or specimens are

delivered;

Second—The weight, or amount, and a short description of each lot thereof;

Third—The name and location of the mine or claim from which it shall be stated that the same has been mined or procured;

Fourth—The name of the party delivering the same;

Fifth—The date of delivery; and

Sixth—Whether the party making the delivery is a lessee, super-

intendent, foreman or workman in such mine.

Such record book shall be open for inspection at all times to the state mineralogist or his authorized agents, and by permit of the state mineralogist issued to any other person who claims under affidavit to have sustained a loss by theft or trespass of property subject to sale under this act.

Section 5.—Provides that licensees who fail to keep records, as above provided, or who make any false entries or use fictitious names, or fail to permit the inspection of books by authorized persons, shall, upon conviction, forfeit their license and become liable to the penalties hereinafter provided.

Section 6.—Provides that any person who shall make any false statement concerning any facts required in section 4 shall be guilty of a

misdemeanor.

Section 7.—Provides that complaints against any licensee shall be made in writing and filed with the state mineralogist. Upon due notice to all interested parties, and after a hearing thereon, the state mineralogist may refuse to issue and shall suspend or revoke any license for any good cause shown.

Section 8.—Provides that any violation of sections 1, 4, and 5 of this act shall be punishable by a fine of not less than \$100 and not more than \$1,000, or by imprisonment for not less than 30 days or more than

6 months, or by both such fine and imprisonment.

The complete text of the new law follows:

## CHAPTER 70.

An act to provide for the regulation, control and licensing of any person, firm or corporation engaging in the business of milling, sampling, concentrating, reducing, purchasing, or receiving for sale ores, concentrates, or amalgams, bearing gold or silver, gold dust, silver or gold bullion, nuggets or specimens; to provide rules and regulations therefor; and to provide penalties for the violation of the provisions of this act.

[Approved April 15, 1925.]

The people of the State of California do enact as follows:

License to handle ores, etc.

Section 1. Hereafter it shall be unlawful for any person, firm, association or corporation, without first procuring the license hereinafter provided for, to engage in the business of milling, sampling, concentrating, reducing, purchasing or receiving for sale ores, concentrates, or amalgams, bearing gold or silver, gold dust, gold or silver bullion, nuggets or specimens. Every person, firm, association or corporation engaged in such business shall pay a license tax of one hundred dollars (\$100) per annum to the State of California. No license shall be granted to any person, firm or association unless such person and the members of such firm or association shall be bona fide residents of the State of California, and no license shall be granted to any joint stock company or corporation organized under the laws of any other state or foreign country unless such company or corporation has complied with all the laws of this state relating to the qualification of foreign corporations to do business in this state; provided, that this section shall not be construed as requiring a license for any mill, sampler, concentration or reduction plant used exclusively by the owner in sampling, milling, reducing or concentrating ores produced by such owner.

Applications for licenses.

SEC. 2. The application for license to carry on such business must be made to the state mineralogist of the State of California, and shall contain the full names and addresses of applicants, if natural persons, and in the case of firms and associations the full names and addresses of the members thereof, and in the case of corporations, the full names and addresses of the officers and directors thereof, and the place or places where such business is to be carried on. Such application shall be sworn to by the person making it. license granted shall date from the first day of the month in which it is issued and expire on the thirty-first day of the following December, and such license or copies thereof shall be kept conspicuously displayed in the place or places of business of the licensee within the State of California. application shall be filed not less than thirty days prior to the granting of such license, and notice of the filing of such application shall be posted in the office of said state mineralogist and be published at the cost of the applicant once a week

Notice.

for three successive weeks in a newspaper published in the county or counties where such business is to be carried on. Protest may be made by any person to the issuing of such Protests. license, and when such protests are filed with the state mineralogist, the latter shall give notice of and hold a public hearing upon said protest before issuing such license. The said state mineralogist shall have the power to reject any applica- Rejection tion or license after a hearing upon such protest as aforesaid, tion. and he shall also have power to revoke any license for failure on the part of the licensee to observe this act or any part thereof, or when the licensee shall have violated the provision or provisions of any law of the State of California relating to ore buying or of any law of said state relating to larceny or receiving stolen property; provided, that no license shall be revoked except upon written charges filed by two or more reputable persons as accusers, specifying the violations of law for which revocation is sought, and after a public hearing as in case of protests against the granting of licenses. An application for a review of any order granting, refusing, or Review revoking, a license made by the state mineralogist under this of order. act, may be made to the superior court in and for the county where the aggrieved parties reside, by any person or persons who may feel aggrieved by such order and whose name or names appear in the record of the proceedings before the state mineralogist as a licensee, applicant for license, protestant, or accuser, by lodging in the office of the clerk of said court a certified copy of the transcript of the proceedings before the state mineralogist, including copies of all papers filed therein. The transcript shall be accompanied by a short petition naming the person or persons applying for the review as plaintiff or plaintiffs and the state mineralogist as defendant, and praying for a review of the order.

Within ten days after lodging such application the party Notice of or parties applying for the review shall serve notice of its pendency. pendency upon the state mineralogist, in writing, and if the review be of an order granting a license or refusing to revoke a license, such notice shall also be served upon the person to whom the license was thereby granted or whose license was

thereby permitted to remain in force.

Such notice may be served by personal delivery or by registered mail, and proof of service shall be made to the satisfaction of the court if not admitted. No review shall be allowed unless taken within thirty days after entry of the order. The Hearing. said court shall try all such reviews upon the transcript, and such evidence as may be offered and admitted. When the court has finally determined any such proceeding, it shall forthwith cause its order in the premises to be certified to the state mineralogist. The costs in such review shall be awarded at the discretion of the court, and if any costs are awarded against the state mineralogist, the same shall be paid out of funds arising from the payment of license fees under this act. When a review is had, as herein provided, of an

order of the state mineralogist revoking a license, such review

shall operate as a stay upon such order.

For the making of the transcript herein provided for, the state mineralogist shall collect from the person or persons ordering the same, twenty-five cents per folio of one hundred words, and twenty-five cents for certifying the same.

The superior court in and for the county or city and county in which the aggrieved party or parties reside shall have the right and jurisdiction to review the action of the state miner-

alogist in granting, refusing, or revoking a license.

Bond.

Actions.

Sec. 3. Each application shall be accompanied by a bond to be approved by the said state mineralogist to the people of the State of California in the penal sum of three thousand dollars (\$3000), with two or more sufficient sureties or by a surety company duly authorized to do business in this state. and conditioned that the obligor will not violate any law applicable to such business. If any person shall be aggrieved by the misconduct of any such licensee through his violation of any law relating to such business, and shall recover a judgment therefor, such person may, after a return unsatisfied in whole or in part of any execution issued upon said judgment, maintain an action in his own name upon such bond herein required in any court of competent jurisdiction. The state mineralogist shall furnish to any one applying therefor a certified copy of any such bond filed with him, upon the payment of a fee of twenty-five cents, and such certified copy shall be prima facie evidence in any court that such bond was duly executed and delivered by each person whose name appears thereon. Said bond shall be renewed and refiled prior to the date of its expiration, or the licensee shall, within thirty days thereafter, cease doing business, and his license shall be revoked by said state mineralogist; but said bond until renewed and refiled, shall remain in full force and effect for a period of three years from the time of approval thereof by the state mineralogist.

Renewal of bond.

Record of ores handled.

SEC. 4. Every person, firm, association or corporation, carrying on such business, shall keep and preserve a book in which shall be entered at the time of the delivery of any ores, concentrates or amalgams, bearing gold or silver, gold dust, gold or silver bullion, nuggets or specimens:

First—The name of the party on whose behalf such ores, concentrates, gold dust, gold or silver bullion, nuggets or

specimens are delivered;

Second—The weight, or amount, and a short description of each lot thereof:

Third—The name and location of the mine or claim from which it shall be stated that the same has been mined or procured:

Fourth—The name of the party delivering the same;

Fifth—The date of delivery; and

Sixth—Whether the party making the delivery is a lessee, superintendent, foreman, or workman in such mine.

Such book shall be open for inspection to the said state Examination mineralogist, his deputies, officers, and agents, on every day of record. except Sundays and legal holidays, between the hours of nine o'clock in the forenoon and five o'clock in the afternoon. If any person, on his own behalf or being duly authorized thereunto by another, shall make and file with the said state mineralogist an affidavit stating that to his best knowledge and belief he or his principals, as the case may be, has, within the three months next preceding the filing of such affidavit, sustained a loss of any of the above described property, by theft or trespass, and that he believes that such property was delivered to a licensee under this act, naming such licensee, the state mineralogist shall forthwith issue a permit to such person to examine the book kept by such licensee under this act; and upon the presentation of such permit to such licensee. such person shall have the right to inspect and examine the entries made in said book during said period of three months. on the same terms and conditions as the state mineralogist.

SEC. 5. Any licensee under this act who shall fail, or neg-Penalties lect or refuse to keep and preserve the book herein provided of act. for shall forfeit his license and shall in addition, upon conviction, be liable to the penalties provided in section eight of this act. Any licensee or other person who shall knowingly make any false entries upon such book, or knowingly enter or cause to be entered upon the same any false or fictitious names, shall upon conviction, be liable to the penalties provided in section eight of this act. Any licensee who shall refuse to permit any person duly authorized as herein provided to inspect said book or the entries therein, shall, on conviction, be liable to the penalties provided for a violation of this act

and shall forfeit his license.

SEC. 6. Any person who shall knowingly make any false Penalty statements concerning any of the facts required to be stated statements. in section four of this act shall be guilty of a misdemeanor.

SEC. 7. Complaints against any licensee or applicant shall Complaints, be made in writing to said state mineralogist, and reasonable decisions. notice thereof, not less than three days, shall be given to said licensee or applicant by serving upon him a copy of such complaint, and a hearing shall be had before the said state mineralogist within one week from the date of the filing of the complaint, and no adjournment shall be taken for longer than one week. A daily calendar shall be kept of all hearings by said state mineralogist, which shall be posted in a conspicuous place in his public office for at least three days before the date of such hearing. The said state mineralogist shall keep a record of all such complaints and hearings, and may refuse to issue and shall suspend or revoke any license for any good cause shown, within the meaning and purpose of this act; and when it is shown that any licensee or applicant under this act, either before or after conviction, is guilty of any conduct in violation of this or any law relating to such business, it shall be the duty of the said state mineralogist of the State of Cali-

fornia to suspend, revoke or reject the license of such licensee or applicant, but notice of the proposed action shall be presented to and reasonable opportunity shall be given licensee or applicant to be heard in his defense. Whenever for any reason such license is revoked, said state mineralogist shall not issue another license to said licensee until the expiration of at least one year from the date of revocation of such license. The state mineralogist shall decide all matters submitted to him within thirty days from the time he takes them under advisement.

Penalties and their enforcement. SEC. 8. Any violation of sections one, four, and five of this act shall be punishable by a fine of not less than one hundred (\$100) dollars and not more than one thousand (\$1,000) dollars, or by imprisonment in the county jail for not less than thirty days or more than six months or both such fine and imprisonment. The said state mineralogist shall notify the district attorney of the county in which the offense occurs of such violation, and the said district attorney shall institute criminal proceedings for the enforcement of this act before any court of competent jurisdiction.

Disposition of funds.

SEC. 9. The expenses of the state mineralogist arising out of this act shall be defrayed out of the moneys paid in from time to time for licenses issued hereunder. Any balance remaining in the hands of said state mineralogist at the end of every six months derived through this act, shall be turned over to the general fund of the state.

Transferal of duties.

SEC. 10. Should the duties of the state mineralogist be transferred to a director or department of mines and mineral resources, all of the powers, rights, duties and responsibilities of the state mineralogist provided in this act shall be thereby transferred to such director or department of mines and mineral resources.

Constitutionality. SEC. 11. If any section, sentence, clause or phrase of this act is for any reason held to be unconstitutional, such decision shall not affect the validity of the remaining portions of this act. The legislature hereby declares that it would have passed this act and each sentence, clause and phrase thereof, irrespective of the fact that any one or more of the sections, sentences, clauses or phrases be declared unconstitutional.

# ADMINISTRATIVE DIVISION.

WALTER W. BRADLEY, Deputy State Mineralogist.

## Personnel.

Prof. W. F. Dietrich, of the Department of Mining, Leland Stanford Junior University, has been engaged by the State Mining Bureau under a cooperative arrangement between the two departments to conduct a survey of the clay resources of California. He is making field examinations during the university's summer vacation period.

Effective August 1st, the following transfers of deputy supervisors are announced by the State Oil and Gas Supervisor: Mr. C. C. Thoms from District 1 to District 2 with headquarters at Santa Paula; Mr. Emil Huguenin from District 4 to District 1 with headquarters at Pacific Finance Building, Los Angeles; Mr. H. A. Godde from District 2 to District 4 with headquarters at Taft.

## New Publications.

During the quarterly period covered by this issue, the following Bureau publications have been made available for distribution:

Mining in California (quarterly), April, 1925, being Chapter 2 of State Mineralogist's Report XXI. Price 25 cents.

Summary of Operations, California Oil Fields: Vol. 10, Nos. 7, 8, and 9, January, February, and March, 1925, respectively.

Commercial Mineral Notes: Nos. 26, 27, 28, May-July (inc.). These 'notes' carry the lists of 'mineral deposits wanted' and 'minerals for sale,' issued in the form of a mimeographed sheet, monthly. It is mailed free of charge to those on the mailing list for 'Mining in California.'

#### Mails and Files.

The Bureau maintains, in addition to its correspondence file and the library, a mine report file which includes reports on some 7500 mines and mineral properties in California. Also, there is available to the public a file of the permits granted to mining and oil corporations by the State Commissioner of Corporations.

During the period covered by this quarterly report, there were 1703 letters received and answered at the San Francisco office alone, covering almost every phase of prospecting, mining and developing mineral deposits, reduction problems, and marketing of refined products.

# DIVISION OF MINERALS AND STATISTICS.

Statistics, Museum, Laboratory.

WALTER W. BRADLEY, Deputy State Mineralogist.

## STATISTICS.

Data on the 1924 production of several of California's minerals were given in the April issue of Mining in California, and some additional ones are presented herein. Copy for the complete annual report for that year is now being prepared and will shortly go to the printer, as Bulletin No. 96 of the State Mining Bureau.

## COPPER.

Copper is second only to gold among the metals produced in California. The output for 1924 amounted to a total of 52,089,349 pounds valued at \$6,823,704, being nearly double the quantity and approximately a 65% increase in value over the 1923 figures which were 28,346,860 pounds, worth \$4,166,989. The increase was due mainly to resumption of operations in Shasta County, but in part also to a larger yield from Calaveras and Plumas counties. The average price in 1924 was 13.1¢ per pound, as against 14.7¢ in 1923, and 13.5¢ in 1922.

Plumas County ranked first for the year, with an output of 25,557,362 pounds; Shasta, second, with 21,109,958 pounds; and Cala-

veras, third, with 4,724,441 pounds.

Distribution of the 1924 copper output, by counties, was as follows:

Copper Production, by Counties, 1924.		
County	Pounds	Value
Calaveras Inyo Madera Plumas Riverside San Bernardino Shasta Trinity Alpine, Amador, El Dorado, Kern, Los Angeles, Merced,	550,000	\$618,902 10,479 4,515 3,348,015 1,166 2,314 2,765,405 72,050
Mono, Nevada, Orange, Sierra *	6,560	858
Totals	52,089,349	\$6,823,704

^{*} Combined to conceal output of a single operator in each.

#### GOLD.

The production of gold in California in 1924 totaled 636,139.72 fine ounces, worth \$13,150,175, being a decrease of 11,070.03 fine ounces from the 1923 yield. As the State Mining Bureau has never independently gathered the statistics of gold and silver production, these figures, as in former years, are published by cooperation with and through the courtesy of Mr. J. M. Hill of the U. S. Bureau of Mines, Department of Commerce (effective July 1, 1925, the former Mineral Resources Division of the U. S. Geological Survey was combined with the Bureau of Mines and transferred to the Department of Commerce).

The largest gold production for 1924 is reported from Nevada County, with an output of 136,419.04 fine ounces (\$2,820,032); Amador County, with 130,927.34 ounces (\$2,706,508) was second; followed by Yuba and Sacramento in third and fourth places, respectively. The drop of Yuba County from first place, which it has held recently, was due to a decline in dredge yield.

Distribution of the 1924 gold production, by counties, was as follows:

#### Gold Production, by Counties, 1924.

County	Value	County	Value
County Amador Butte Calaveras Del Norte El Dorado Fresno Humboldt Imperial	Value \$2,706,508 484,530 853,961 325 28,207 32,978 1,269 258	County Nevada Placer Plumas Riverside Sacramento San Bernardino San Diego Shasta	Value \$2,820,032 108,757 277,571 1,070 1.150,687 187,573 4,830 346,622 799,276
Kern Lassen Los Angeles Madera Mariposa Merced Mono	154,132 2,250 751 3,208 182,099 355 49,651	Siskiyou Stanislaus Trinity Tuolumne Yuba Total	63,570 196,019 422,281 255,994 1,995,434

#### LEAD.

Lead production in California in 1924 decreased to approximately 50% of the amount shown in the preceding year. The principal output was from silver-lead ores from Inyo County. The total recoverable lead in ores shipped from California mines in 1924 amounted to 4,984,387 pounds valued at \$398,751, compared with 9,934,522 pounds and \$695,416 in 1923. The average price in 1924 was 8.0¢ as against 7.0¢ in 1923, 5.5¢ in 1922, and 3.9¢ in 1913.

The 1924 production was distributed by counties as follows:

Lead Production, by Counties, 1924.	Pounds	Value
Inyo	4,813,718	\$385,098
Mono	$32,458 \\ 26,817$	2,597 $2,145$
San BernardinoShasta	$31,668 \\ 6,615$	2,533 529
Alpine, Amador, Calaveras, Kern, Los Angeles, Merced, Nevada, Orange *	73.111	5.849
Totals	4,984,387	\$398,751

^{*} Combined to conceal output of a single operator in each.

#### PETROLEUM.

The crude oil production of California for 1924 amounted to a total of 228,933,471 barrels of clean oil, valued at \$274,652,874 at the well. This total of quantity is compiled from the monthly production reports filed by the operators with the State Oil and Gas Supervisor, to which have been added figures for the output of a number of small operators in the Los Angeles city field not under the jurisdiction of the Supervisor.

The question of the value of the crude oil yield, at the well, is a difficult one to settle with exactitude, principally because a large part of the output is not sold until after refining. The large refiners are also large producers of crude oil which they send direct from well to plant, hence much of the crude is not sold as such. The values used in the statistical reports of the State Mining Bureau since 1914 have been derived from averages of actual sales of crude oil of all grades in each field of the state, and these averages applied to the total yield of the respective fields. This we feel is a safer measure of commercial values than market quotations, because quotations do not always mean sales

#### Features of 1924.

The noteworthy features of the year 1924 in the oil industry of California were the decrease in gusher production in the new fields in the Los Angeles Basin, and the increase in the market value per barrel for crudes. Quantities in Los Angeles and Orange counties decreased, while Fresno, Kern, and Ventura registered material increases. In Fresno and Kern counties, much of the shut-in production was again opened up and drilling activity also resumed. There were two increases in 1924 in prices quoted for crude oil at the well announced by the marketing companies: One, February 5, affecting all grades; and the other, September 24, for high-gravity crude in the new Rosecrans field.

Estimating in January the output of the year just closed, the State Oil and Gas Supervisor 1 presented the following observations:

"The production of oil in California in 1924 was 230,045,000 barrels, according to statistics of the American Petroleum Institute, including estimates for the month of December. This is 33,682,895 barrels less than was produced in 1923. "An analysis of the increases and decreases in the various parts of the State is of value in showing the effect of decline just following the flush period of some fields, partly offset by the development of new fields and the resumption of closed-in production in some of the older fields.

"The greatest declines were in the Santa Fe Springs, Huntington Beach and Long Beach fields, which produced 78,964,000 barrels less in 1924 than in 1923, distributed as follows: Santa Fe Springs, 53,385,000; Huntington Beach, 16,863,000; Long Beach, 8,716,000.

"The decline was partly offset by an increase of 45,283,000 barrels in other fields, the fields of the San Joaquin Valley producing 19,677,000 barrels more in 1924, both from new wells and from wells shut down during all or part of 1923; Torrance and the new fields Dominguez and Rosecrans contributing increased production as follows: Torrance 14,377,000 barrels, Dominguez 6,623,000 barrels, Rosecrans 620,000 barrels; the Coyote Hills field, practically shut down during part of 1923, contributing 3,206,000 barrels more in 1924 than in 1923; and miscellaneous 780,000 barrels."

#### Outlook for 1925.

It is difficult to predict, as yet, for 1925. Lacking the opening up of any new field, it appears thus far that the output for the current vear will probably be less in total quantity than the year 1924, due largely to the decline in the Los Angeles Basin fields.

#### Production Figures.

The following table gives the production and value by counties for 1924, compared with the 1923 figures:

#### Production and Value of Crude Oil, by Counties.

	19	23	19	924
County	Barrels	Value	Barrels	Value
Fresno	5,061,542	\$3,593,695	10,156,405	\$11,801,743
Kern	45,952,794	37,629,300	61,175,405	69,572,934
Los Angeles	158,665,019	154,063,733	119,027,428	147,474,953
Orange		40,897,930	31,661,283	37,455,298
San Luis Obispo		19,793	31,222	30,972
Santa Barbara	3,061,947	2,394,433	2,905,181	3,009,768
Santa Clara	, ,	, ,	14,417	20,481
Ventura		4,109,084	3,958,010	5,279,985
San Mateo and Santa Clara	15,685	23,341		
San Bernardino and San Mateob			4,120	6,740
Totals	262 875 690	\$242 731 309	228 933 471	\$274 652 874

^a Combined to conceal output of a single operator in San Mateo County.

^b Combined to conceal output of a single operator in each.

The foregoing totals show a state average price of \$1.200 per barrel for the year 1924, as compared to \$0.923 in 1923 and \$1.249 in 1922.

⁴ Bush, R. D., Weekly press bulletin, No. 481: Dept. of Petr. and Gas; Cal. State Min. Bur., Jan. 10, 1925.

11.356

## Oil in 'Storage.'

Field, refinery, pipe-line, and tank-farm stocks of crude and refinery products in Pacific Coast territory totaled 125,021,964 barrels, December 31, 1924, compared with 116,727,442 barrels on December 31, 1923, distributed as follows:

Stocks	Dec. 31, 1924 (Barrels)	Dec. 31, 1923 (Barrels)
Heavy Crude, heavier than 20° A. P. I., including all grades of fuel————————————————————————————————————	57,254,796 $40,574,578$ $10,957,487$ $9,396,613$ $6,838,490$	52,393,302 36,880,942 7,696,815 13,114,490 6,641,893
Total all stocks	125,021,964	116,727,442

Beginning with September, 1924, the American Petroleum Institute in reporting 'stocks' and 'storage' expanded their figures to include 'stocks of all products held by the principal marketing companies at all points in all the Pacific coast territory including British Columbia, Alaska, and Hawaii.' Hence, the above tabulation is not comparable with the figures shown in our previous statistical reports which showed stocks in California only.

#### Proved Oil Land.

The total proved oil land of the state increased to 118,979 acres in 1924, as against 116,868 acres in 1923. Of this 1924 total, 21,556 acres being owned by federal, state, and city governments, or for other reasons, is not assessable for the support of the Department of Petroleum and Gas of the State Mining Bureau. The acreage in 1924 was distributed by counties, as follows:

Proved Oil Land and Number of Wells, 1924.		
· · · · · · · · · · · · · · · · · · ·	Land	Number
Constant		m + 041111000
County	(acres)	wells
Phoces	14.646	1.105
Fresno		
Kern	74.270	6.015
Los Angeles *	10,763	2,212
Orange	6.902	1.082
San Bernardino		1
San Luis Obispo	402	19
San Mateo		4
Santa Barbara	7.813	377
Santa Clara	80	12
Ventura	4,103	529

^{*} Not including the old Los Angeles City Field.

## SILVER.

Except for the early-day production of the silver mines of the Calico district and the more recent production from those of the Randsburg district (both being in San Bernardino County), the recovery of silver in California has been largely as a by-product from its association with copper, lead, zinc, and gold ores.

The 1924 silver output of California totaled 3,555,153 fine ounces, valued at \$2,381,952, compared with 3,559,443 fine ounces and \$2,918,743 in 1923. The average price of domestic silver during 1924 was 67¢ per ounce at New York, as against 82¢ in 1924, and \$1.00 in 1921–1923 under the Pittman Act. The figures below are those of the U. S. Bureau of Mines, Department of Commerce (as explained under

¹ Standard Oil Bulletin, February, 1925, p. 13.

Gold), to which has been added a small figure from Alpine County not included by that bureau, being less than \$100.

The distribution of the 1924 silver yield, by counties, was as follows:

## Silver Production, by Counties, 1924.

County	Fine ounces	Value
Amador Butte	27,240 3,161	\$18,251 2.118
Calaveras	11.139	7.463
El Dorado	228	153
Fresno	283	190
Humboldt	10	7
ImperialInyo	2	1 1 7 7 0 0
Kern	$172,834 \\ 53.585$	$115,799 \\ 35,902$
Lassen	95,989 65	35,904
Los Angeles	8,232	5.515
Madera	262	176
Mariposa	2,400	1,608
Merced	2	_1
Mono	9,660	6,472
Nevada Placer	58,585	39,252
Placer Plumas	$\frac{797}{369.506}$	534 $247.569$
Riverside	867	581
Sacramento	2.617	1,753
San Bernardino	2,285,967	1.531.598
San Diego	145	97
Shasta	512,541	343,402
Sierra	7,758	5,198
Siskiyou	442	296
Stanislaus	1,154 $16,320$	773 $10.934$
Tuolumne	1,651	1,106
Yuba	6,658	4,461
Alpine and Orange *	1,042	698
Totals	3,555,153	\$2,381,952

^{*} Combined to conceal output of a single operator in each.

#### ZINC.

Recoverable zinc in ores mined in California in 1924 amounted to 3,060,000 pounds, valued at \$198,900, and was marketed entirely in the form of the oxide. The average price per pound quoted for the metal in 1924 was  $6.5\phi$ . There was no recoverable zinc mined in California in 1923.

## MUSEUM.

The Museum of the State Mining Bureau possesses an exceptionally fine collection of rocks and minerals of both economic and academic value. It ranks among the first five of such collections in North America; and contains not only specimens of most of the known minerals found in California, but much valuable and interesting material from other states and foreign counties as well.

Mineral specimens suitable for exhibit purposes are solicited, and their donation will be appreciated by the State Mining Bureau as

well as by those who utilize the facilities of the collection.

The exhibit is daily visited by engineers, students, business men, and prospectors, as well as tourists and mere sightseers. Besides its practical use in the economic development of California's mineral resources, the collection is a most valuable educational asset to the state and to San Francisco.

### LABORATORY.

FRANK L. SANBORN, Mineral Technologist.

The price of antimony continues to be such that deposits containing good ores of this metal can be profitably worked. It has been claimed by producers of California antimony that the metal could not be mined at a profit unless the price was above 12¢ per pound. The present antimony price of about 16¢ per pound should make it possible to profitably mine this metal in California.

The occurrence of antimony has been noted in many of the counties of the state, but Kern, Inyo and San Benito were the chief producers during 1916 when the price was also high. Large deposits of antimony are said to occur in the Panamint Mountains in the vicinity of Wild Rose Springs, and in the Argus Mountains. Mono and Alpine counties

may also have good deposits of antimony.

The Bureau received 1263 samples for identification during the three-month period covered by this report. Samples were received from practically every county in the state.

## LIBRARY.

FOREST L. CAMPBELL, Librarian.

In addition to the numerous standard works, authoritative information on many phases of the mining and mineral industry is constantly being issued in the form of reports and bulletins by various government agencies.

The library of the State Mining Bureau contains some five thousand selected volumes on mines, mining and allied subjects, and it is also a repository for reports and bulletins of the technical departments of federal and state governments and of educational institutions, both

domestic and foreign.

It is not the dearth of the latter publications, but rather a lack of knowledge of just what has been published and where the reports may be consulted or obtained, that embarrasses the ordinary person seeking specific information.

To assist in making the public acquainted with this valuable source of current technical information, 'Mining in California' contains under this heading a list of all books and official reports and bulletins received,

with names of publishers or issuing departments.

Files of all the leading technical journals will be found in the library, and county and state maps, topographical sheets and geological folios. Current copies of local newspapers published in the mining centers of the State are available for reference.

The library and reading room are open to the public during the usual office hours, when the librarian may be freely called upon for all necessarv assistance.

## OFFICIAL PUBLICATIONS RECEIVED.

## Governmental.

U. S. Geological Survey:

Professional Paper No. 132—Shorter contributions to General Geology, 1923—1924. By W. S. Mendenhall. Professional Paper No. 132-I—Origin of the Boghead Coals. By Reinhardt

Theissen.

Professional Paper No. 132-J-Aniakchak Crater, Alaska Peninsula. By W. R. Smith.

Mineral Resources of the United States:

Sulphur and Pyrites in 1924.

Gold, Silver and Copper in South Dakota and Wyoming in 1923.

Gold, Silver, Copper, Lead and Zinc in Nevada in 1923. Gold, Silver, Copper, Lead and Zinc in Utah in 1923.

Gold, Silver, Copper, Lead and Zinc in Washington in 1923.

Gold and Silver in 1923. Natural Gas in 1923.

Bulletin No. 757—Geology and Coal Resources of the Axial and Butte Quadrangles, Moffat County, Colo. By E. T. Hancock.

Bulletin No. 772—A Reconnaissance of the Point Barrow Region, Alaska. By Sidney Paige.

Bulletin No. 750-Contributions to Economic Geology, Part I-Metals and Nonmetals Except Fuels.

Bulletin No. 763—Geology and Ore Deposits of the Arapaipa and Stanley

Mining Districts, Graham County, Ariz. By C. P. Ross, Bulletin No. 759—Geology of the Bristol Quadrangle, Creek Co., Oklahoma. By A. E. Fath.

Bulletin No. 760-D—Pedestal Rocks in Stream Channels. By K. Bryan, Bulletin No. 760-C—Erosion by Solution and Fill. By W. T. Lee,

Bulletin No. 773-B—Mineral Investigations in Southeastern Alaska. Bulletin No. 773-C—The Occurrence of Copper on Prince William Sound, Alaska. By F. D. Moffit.

Bulletin No. 773-A-Alaska's Mineral Resources and Production in 1923. By A. H. Brooks.

Bulletin No. 751—Contributions to Economic Geology, 1923-1924, Part II, Mineral Fuels.

Water Supply Paper No. 509—Colorado River Basin.

Water Supply Paper No. 537-A Study of Coastal Ground Water with special reference to Connecticut. By J. S. Brown.

Water Supply Paper No. 560-B-Chemical Character of Ground Waters of the Northern Great Plains. By H. B. Riffenburg.

Water Supply Paper No. 560-C-Index of Analysis of Natural Waters in the United States. By W. D. Collins.

Water Supply Paper No. 520-F-Temperature of Water Available for Indus-

trial Use in the United States. By W. D. Collins.
Water Supply Paper No. 520-G—Some Floods in the Rocky Mountain Region. By R. Follansbee and P. V. Hodges.

Water Supply Paper No. 523-Part III-Ohio River Basin.

Water Supply Paper No. 536—Surface Water Supply of the New-Kanawha River Basin.

Water Supply Paper No. 539—Geology and Ground Water Resources of

Townsend Valley, Montana. By J. T. Pardee. Water Supply Paper No. 531—Surface Water Supply of the United States, Part XI—Pacific Slope Basins in California.

U. S. Bureau of Mines:

Bulletin No. 224—Surface Machinery and Methods for Oil Well Pumping. By H. C. George.

Bulletin No. 248—Metal Mine Accidents in the United States in 1923. Bulletin No. 246—Quarry Accidents in the United States in 1923.

Bulletin No. 233—Protection of Oil and Gas Equipment against Corrosion. By R. Van A. Mills, Bulletin No. 226—The Treatment of Manganese-Silver Ores, By G. H.

Clevenger.

Bulletin No. 251—Coal Mine Fatalities in the United States in 1924.

Bulletin No. 234—Screen Sizing of Coal, Ores and Other Minerals. By E. A. Holbrook.

Technical Paper No. 374—Accidents at Metallurgical Works in the United States in 1923.

Technical Paper No. 357—A Critical Study of the Burrell Indicator for Combustible Gases in Air. By L. H. Milligan,

Technical Paper No. 360—Vapor Pressures of the Common Metallic Chlorides. By C. G. Maier.

Technical Paper No. 345-Analyses of Utah Coals.

Technical Paper No. 341-Metallurgical Treatment of Zinc-retort Residues. By B. M. O'Harra.

Technical Paper No. 335—Bituminous Coal as Generator Fuel for Large Water Gas Sets with Waste Heat Boilers. By W. A. Dunkley.

Reports of Investigation:

Serial No. 2681—Explosives Used in February, 1925. By W. W. Adams. Serial No. 2682—Line Radio and the Effects of Metallic Conductors on Underground Communication. By J. J. Jakosky and D. H. Zellers, Serial No. 2683—The Formation of Oil-Field Emulsions. By D. B. Dow. Serial No. 2684—Coal-Mine Fatalities in March, 1925. By W. W. Adams. Serial No. 2685—Bibliography on Economic Utilization of Mine Timber.

By H. E. Tufft and R. R. Hornor.

Serial No. 2686-A Convenient Method for Determining Gum-Forming Material in Gasoline. M. B. Cooke.

Serial No. 2687—Explosives used in March, 1925. W. W. Adams.

Serial No. 2688-Methods Used for Dehydration of Oil-Field Emulsions. D. B. Dow

Serial No. 2689—Coal-Mine Fatalities in April, 1925. W. W. Adams.

Serial No. 2690—Consumption of Explosives in April, 1925. By Adams.

Serial No. 2691—Recent Developments in the Production and Consumption of Abrasive Garnet. By W. M. Myers and C. O. Anderson,

Serial No. 2692—The Physical Chemisty of Oil-Field Emulsions, By D. B. Dow and C. E. Reistle, Jr.

U. S. Department of Commerce:

Simplified Practice Recommendation No. 14—"Roofing Slate."

Bureau of Standards:

Technologic Paper No. 262-Comparison of American and Foreign Clays as Paper Fillers. By Merle B. Shaw.

Circular No. 100—Nickel and Its Alloys. Circular No. 151—Wall Plaster; Its Ingredients, Preparation and Properties. Scientific Paper No. 483—Investigation on the Platinum Metals.

U. S. Department of Agriculture, Miscellaneous Circular No. 39-Report of the National Conference on Utilization of Forest Products.

U. S. National Museum, Proceedings of-Vol. 64.

Alabama, Geological Survey of:

Bulletin No. 30—Supplemental List of Economic Minerals and Rocks of Alabama. By W. B. Jones.

Mineral Industries of Alabama. By E. A. Smith.

Special Report No. 13-Rock Asphalt of Alabama and Their Use in Paving. By G. H. Clark.

California, Department of Public Works, Biennial Report of the Division of Water Rights.

Florida Geological Survey-16th Annual Report.

Georgia, Geological Survey of—Bulletin No. 42—Physical Geography of Georgia.

By L. La Forge.

Idaho Bureau of Mines and Geology-Pamphlet No. 13-A Geologic Reconnaissance of the Mineral and Cuddy Mountain Mining District, Washington and Adams Counties, Idaho. By D. C. Livingstone. Twenty-sixth Annual Report of the Mineral Industry in Idaho for the year

1924. By Stewart Campbell, Inspector of Mines.

Reprint No. 1-Phosphate Deposits of Idaho and Their Relation to the World

Supply. By V. D. Kirkham.

Bulletin No. S—Geology and Oil Possibilities of Bingham, Bonneville and Caribou Counties, Idaho. By V. D. Kirkham.

Bulletin No. 9—Geology and Gold Resources of Boise Basin, Boise County,

Idaho. By S. M. Ballard. Bulletin No. 10—Geology and Gold Resources of North Central Idaho. By F. A. Thomson.

Illinois Geological Survey:

Report of Investigations, No. 2-Structure of Parts of Northeastern Williamson and Western Saline Counties. By Gilbert H. Cady. Report of Investigations, No. 5-Structure of Herrin (No. 6) Coal Seam near

Duguoin. By D. J. Fisher.

Report of Investigations, No. 4-Carbon Ratios and Petroleum in Illinois. By G. F. Moulton.

Bulletin No. 46-Limestone Resources of Illinois. By J. E. Lamar and Frank Krey.

Iowa Geological Survey-Vol. XXX-Annual Report, 1921-1922, with Accompanying papers.

Kentucky Geological Survey-Wild Life in Kentucky. By W. D. Funkhauser.

Missouri Bureau of Mines and Geology:

Biennial Report of the State Geologist for the Period Ending Jan. 1, 1925. Vol. XVIII—Structural Reconnaissance of the Mississippi Valley Area from Old Monroe, Mo., to Nauvoo, Ill. By Frank Krey.

New Jersey, Department of Conservation and Development—Annual Report for the years ending June 30, 1922 and 1923.

North Dakota Geological Survey-Bulletin No. 4-The Lignite Deposits of North Dakota. By A. G. Leonard.

Ohio Geological Survey-Bulletin No. 28-Geology of Columbiana County. By Wilber Stout.

South Dakota Geological and Natural History Survey:

Circular No. 20-The Possibilities of Oil in Western Zieback County. By W. L. Russell.

Circular No. 22—Structures in Northern Haakon Co. By F. Ward. Circular No. 23—Oil and Gas Possibilities in Northern Meade County. Roy A. Wilson.

The Biennial Report of the State Geologist, 1922-1924.

407 LIBRARY.

Thirty-fourth Report of the State Mine Inspector for the State of South Dakota,

Vermont, Report of the State Geologist on the Geology and Mineral Industries of, 1923-1924.

Wisconsin Geological Survey-Bulletin No. 57-Phytoplankton of the Inland Lakes of Wisconsin. By G. M. Smith.

Argentina, Ministerio de Agricultura:

Publicacion No. 1-Contribucion al Estudio de las Aguas Termo Minerales de Puente del Inca.

Publicacion No. 2-Nuevas Observaciones en La Parte Oriental del Neuquen y en el Territorio del Rio Negro.

Publicacion No. 3-Estadistica Minera de la Nacion en 1919.

Publicacion No. 1-Contribucion a la Paleontologia del Jurasica Sud Americana. South Australia-Annual Report of the Director of Mines and Government Geologist for 1923.

Geological Survey of South Australia-Bulletin No. 11-Some Developments in Shallow Water Areas in the North East of South Australia. By R. Lockhart Jack.

Western Australia-Annual Report of the Geological Survey for the year 1923. New South Wales Legislative Assembly-Annual Report of the Department of Mines for the year 1924.

Quebec Department of Colonization, Mines and Fisheries—Report on Mining Operations in the Province of Quebec During the Year 1924.

Ontario Department of Mines—33rd Annual Report of the Ontario Dept. of Mines, Dominion Fuel Board—The Smoky River Coal Field. By James McEvoy.

Canada Department of Mines:

Investigations in Ceramics and Road Materials, 1923.

Investigations of Mineral Resources and the Mining Industry, 1923.

Investigations of Fuels and Fuel Testing, 1923. Investigations in Ore Dressing and Metallurgy, 1923.

Bulletin No. 39—Color Printing of Geological Maps. By C. Senecal.

Finland, Commission Geologique de:

No. 68—Jordskredet I Jaarila. By V. Tanner.

No. 71—Om Diabasgangar I Mellerstra, Finland, By W. W. Wilkinan.

No. 70—The Average Composition of the Earth's Crust in Finland. By J. J. Sederholm.

Great Britain, Geological Survey of:

The Geology of North London. By C. N. E. Bromhead,

The Geology of the Country around Marlborough. By H. J. White,

Japan Imperial Geological Survey:

Report 91-Magnetite Sand in Ono-mura in the Prefecture of Iwate. By Yozo Okamura.

Report 92—Annual Report for the Year Ending March 31, 1924.

Industrial Mineral Survey Report—20-21 and 22

Mexico Departamento de Minas-Anuario de Estadistica Minera Correspondiente al Año de 1923.

Boletin de Museo Nacional de Rio de Janiero, No. 4-Maio.

Spain-Memorias de la Real Academia de Ciencias y Arts-Vol. XVIII, Num. 17 to 23.

Transvaal Chamber of Mines-Reports of the Executive Committee, Gold Producers Committee and the Colleries Committee for 1924.

California, University of, Department of Geology:

The San Onofre Breccia, Its Nature and Origin. By A. O. Woodward.

Notes on the Genus Venericardia from the Eccene of the West Coast of North America. By Marcus A. Hanna.

Avidauna of the McKittrick Pleistocene. By Loye Miller.

Minnesota, University of-Mining Directory of Minnesota, 1925.

Minesota School of Mines Experiment Station:

Bulletin No. 1-Iron Mining in Minnesota. By C. E. van Barneveld.

Bulletin No. 2 - Preliminary Concentration Tests of Mesabi Ores. By W. R. Appleby.

Bulletin No. 3-Preliminary Concentration Tests on Cuyuna Ores. By W. R. Appleby.

Bulletin No. 4-Bibliography of Minnesota Mining and Geology. By Winifred Gregory.

Bulletin No. 5-Manganiferous Iron Ores of the Cuyuna District. By Edmund Newton.

Bulletin No. 7-The Future of the Lake Superior District as an Iron Ore Producer. By E. W. Davis.
Bulletin No. 9—Magnetic Concentration of Iron Ore. By E. W. Davis.

Missouri, University of—Mechanical Underground Loading in Metal Mines. C. E. Van Barnefeld.

California Acadamy of Sciences-Fauna and Stratigraphic Relations of the Tejon Eocene at the Type Locality in Kern County, Cal.

Philadelphia, Academy of Natural Sciences of-Yearbook for the year ending December 31, 1924.

Field Museum of Natural History-Publication No. 227. Annual Report of the Director to the Board of Trustees for 1924.

Tohoku Imperial University, Sendai, Japan—Science Reports, Vol. II, No. 3.

Waseda University, Tokyo, Japan-Memoirs of the College of Science and Engineering, No. 2, 1925.

#### Books.

The Ore Magmas. By J. E. Spurr.

The American Society of Mechanical Engineers—The Engineering Index for 1924.

## Topographic Maps.

Alexis, Ill. Arcade, N. Y. Casa Grande, Ariz. Denver Mountain Parks, Colo. Divernon, Ill. Du Bois, Pa. Elkhead Creek, Colo. Ellicottville, N. Y. Franklinville, N. Y. Inglewood, Cal. *Kingwood, W. Va. Molokai, Hawaii. Hanford, Cal. Goshen, Cal.

*Morgantown, W. Va.-Pa. Perryville, Mo. Petronilla, Tex. Reelfoot Lake, Tenn.-Mo.-Ky. Scooteney Lake, Wash. Signal Peak, Ariz. Springville, N. Y. Standard Symbols. Stoddartsville, Pa. Venice, Cal. Watts, Cal. Winston, Mo. Lemoore, Cal.

#### Current Magazines on File.

For the convenience of persons wishing to consult the technical magazines in the reading room, a list of those on file is appended:

American Petroleum Institute, New York. Architect and Engineer, San Francisco. Arizona Mining Journal, Phoenix, Arizona. Asbestos, Philadelphia, Pennsylvania. Brick and Clay Record, Chicago. Bulletin, Union Oil Co., Los Angeles. California Journal of Development, San Francisco.

Cement, Mill and Quarry, Chicago, Illinois. Chemical Engineering and Mining Review, London, England.

Engineering and Mining Journal-Press, New York.

Explosives Engineer, Wilmington, Del. Financial Insurance News, Los Angeles, California.

Graphite, Jersey City.

Journal of Electricity and Western Industry, San Francisco.

Metallurgical and Chemical Engineering, New York.

Mine and Quarry, Chicago.

Mining and Engineering Record, Vancouver, B. C.

Mining and Oil Bulletin, Los Angeles.

Oil Age, Los Angeles.

Oil and Gas Journal, Tulsa. Oklahoma.

Oil and Gas News, Kansas City.

Oil News, Galesburg, Illinois.

Oildom, New York.

^{*} New edition.

409 LIBRARY.

Oil, Paint and Drug Reporter, New York.

Oil Trade Journal, New York. Oil Weekly, Houston, Texas.

Petroleum Age, New York.

Petroleum Record, Los Angeles. Petroleum World, Los Angeles.

Queensland Government Mining Journal, Brisbane, Australia.

Rock Products, Chicago, Illinois.

Safety News, Industrial Accident Commission, San Francisco.

Salt Lake Mining Review, Salt Lake City, Utah.

Southwest Builder and Contractor, Los Angeles.

Standard Oil Bulletin, San Francisco.

Stone, New York.
The Record, Associated Oil Company, San Francisco.

Through the Ages, Baltimore.

## Newspapers.

The following papers are received and kept on file in the library:

Amador Dispatch, Jackson, Cal.

Arkansas Oil and Mineral News, Hot Springs National Park (Arkansas).

Barstow Printer, Barstow, Cal.

Blythe Herald, Blythe, Cal.

Bridgeport Chronicle-Union, Bridgeport, Mono Co., Cal.

Calaveras Prospect, San Andreas, Cal.

California Oil World, Los Angeles, Cal. Cloverdale Reveille, Cloverdale, Cal.

Colusa Daily Sun, Colusa, Cal. Daily Commercial News, San Francisco, Cal.

Daily Midway Driller, Taft, Cal. Del Norte Triplicate, Crescent City, Cal.

Exeter Sun, Exeter, Cal.

Gateway Gazette, Beaumont, Cal.

Goldfield News, Goldfield, Nevada.

Guerneville Times, Guerneville, Cal.

Healdsburg Enterprise, Healdsburg, Cal. Humboldt Standard, Eureka, Cal.

Inyo Independent, Independence, Cal.

Inyo Register, Bishop, Cal.

Ione Valley Echo, Ione, Cal. Lake County Bee, Lakeport, Cal. Mining and Financial Record, Denver, Colo.

Mining Topics, Sacramento, Cal., and Unionville, Nev. Mountain Democrat, Placerville, Cal.

Mountain Messenger, Downieville, Cal.

Nevada Mining Press, Reno, Nevada.

Oatman Mining News, Oatman, Arizona. Oregon Observer, Grants Pass, Oregon.

Oroville Daily Register, Oroville, Cal.

Petroleum Reporter, Taft, Cal.

Placer Herald, Auburn, Cal.

Plumas Independent, Quincy, Cal.

Plumas National Bulletin, Quincy, Cal.

Randsburg Times, Randsburg, Cal. San Diego News, San Diego, Cal.

Shasta Courier, Redding, Cal. Siskiyou News, Yreka, Cal.

Stockton Record, Stockton, Cal.

Tuolumne Prospector, Tuolumne, Cal. Ventura Daily Post, Ventura, Cal.

Weekly Trinity Journal, Weaverville, Cal.

Western Sentinel, Etna Mills, Cal.

## PRODUCERS AND CONSUMERS.

The producer and consumer of mineral products are mutually dependent upon each other for their prosperity, and one of the most direct aids rendered by the Bureau to the mining industry in the past has been that of bringing producers and consumers into direct touch with each other.

This work has been carried on largely by correspondence, supplemented by personal consultation. Lists of buyers of all the commercial minerals produced in California have been made available to producers upon request, and likewise the owners of undeveloped deposits of various minerals, and producers of them, have been made known to those looking for raw mineral products.

When the publication of MINING IN CALIFORNIA was on a monthly basis, current inquiries from buyers and sellers were summarized and lists of mineral products or deposits 'wanted' or 'for sale' included in

each issue.

It is important that inquiries of this nature reach the mining public as soon as possible and in order to avoid the delay incident to the present quarterly publication of MINING IN CALIFORNIA, these lists are now issued monthly in the form of a mimeographed sheet under the title of 'Commercial Mineral Notes.'

# EMPLOYMENT SERVICE.

Following the establishment of the Mining Division branch offices in 1919, a free technical employment service was offered as a mutual aid to mine operators and technical men for the general benefit of the mineral industry.

Briefly summarized, men desiring positions are registered, the cards containing an outline of the applicant's qualifications, position wanted, salary desired, etc., and as notices of 'positions open' are received, the names and addresses of all applicants deemed qualified are sent to the prospective employer for direct negotiations.

Telephone and telegraphic communications are also given immediate

attention.

The Bureau registers technical men, or those qualified for supervisory positions, and vacancies of like nature, only, as no attempt will be made

to supply common mine and mill labor.

A list of current applications for positions and 'positions open' is carried in each issue. Notices are designated by a key number, and the name and address corresponding to any number will be supplied upon request, without delay or charge of any kind. If desired, recommendations may be filed with an application, but copies only should be sent to the Bureau, to avoid possible loss. Registration cards for the use of both prospective employers and employees may be obtained at any office of the Bureau upon request, and a cordial invitation is extended to the industry to make free use of the facilities afforded.

## POSITIONS WANTED.

- 31–14 Foreman, assayer, etc., at small mine. Ten years' experience as timber man, foreman, superintendent. Can run stamp mill, compressors, gas engines, motors, etc. Age 45. Married. Salary open. References.
- 31-15 Superintendent of coal mine. Fifteen years' experience as coal mine manager. Age 42, married. Salary open. References.
- 31-16 Geological exploration. Twenty years' experience foreign and U. S., as mining engineer, manager, etc., in platinum, gold and coal fields. Russian, speaks good English. Age 39, single. Salary open. References.
- 31-17 Mining engineer. One year's experience. Age 26, married. Salary wanted, \$175. References.
- 31-18 Analytical and metallurgical chemist. Technical graduate. Twelve years' experience research, testing and analytical work. Accustomed to various engineering plants. Age 38, married. Will consider minimum of \$200. Reference.
- 31-19 Draftsman, Eight years' experience, shipbuilding, electric, petroleum and highway lines. Age 33, single. References. Salary wanted, \$175.
- 31-20 Field Exploration. Forty years' experience in prospecting, etc. Wants grubstake contract, expenses and interest in whatever is found. Will not leave U. S. Age 65. Single. References.



# PUBLICATIONS OF THE CALIFORNIA STATE MINING BUREAU.

During the past forty-four years, in carrying out the provisions of the organic act creating the California State Mining Bureau, there have been published many reports, bulletins and maps which go to make up a library of detailed information on the mineral industry of the state, a large part of which could not be duplicated from any other source.

One feature that has added to the popularity of the publications is that many of them have been distributed without cost to the public, and even the more elaborate ones have been sold at a price which barely covers the cost of printing.

Owing to the fact that funds for the advancing of the work of this department have often been limited, many of the reports and bulletins mentioned were printed in limited editions which are now entirely

exhausted.

Copies of such publications are available, however, in the Bureau's offices in the Ferry Building, San Francisco; Pacific Finance Building, Los Angeles; in Sacramento; Santa Maria; Santa Paula; Coalinga; Taft; Bakersfield. They may also be found in many public, private and technical libraries in California and other states, and foreign countries.

A catalog of all publications of the Bureau, from 1880 to 1917,

giving a synopsis of their contents, is issued as Bulletin No. 77.

Publications in stock may be obtained by addressing any of the offices of the State Mining Bureau and enclosing the requisite amount in the case of publications that have a list price. The Bureau is authorized to receive only coin, stamps or money orders, and it will be appreciated if remittance is made in this manner rather than by personal check.

The prices noted include delivery charges to all parts of the United States. Money orders should be made payable to the State Mining

Bureau.

#### REPORTS.

Asterisks (**) indicate the publication is out of print.	Price
**First Annual Report of the State Mineralogist, 1880, 43 pp. Henry G.	
**Second Annual Report of the State Mineralogist, 1882, 514 pp., 4 illustrations, 1 map. Henry G. Hanks	
**Third Annual Report of the State Mineralogist, 1883, 111 pp., 21 illustrations, Henry G. Hanks	
**Fourth Annual Report of the State Mineralogist, 1884, 410 pp., 7 illustrations. Henry G. Hanks	
**Fifth Annual Report of the State Mineralogist, 1885, 234 pp., 15 illustrations, 1 geological map. Henry G. Hanks	
**Sixth Annual Report of the State Mineralogist, Part I, 1886, 145 pp., 3 illustrations, 1 map. Henry G. Hanks	
**Part II, 1887, 222 pp., 36 illustrations. William Irelan, Jr**Seventh Annual Report of the State Mineralogist, 1887, 315 pp. William	
Irelan, Jr.  **Eighth Annual Report of the State Mineralogist, 1888, 948 pp., 122 illustra-	
tions. William Irelan, Jr.	
**Ninth Annual Report of the State Mineralogist, 1889, 352 pp., 57 illustrations, 2 maps. William Irelan, Jr	

#### REPORTS—Continued.

Asterisks (**) indicate the publication is out of print.	
**Tenth Annual Report of the State Mineralogist, 1890, 983 pp., 179 illustra-	Price
tions, 10 maps. William Irelan, Jr	\$1.00
**Twelfth Report (Second Biennial) of the State Mineralogist, for the two years ending September 15, 1894, 541 pp., 101 illustrations, 5 maps.  J. J. Crawford	φ1.00
**Thirteenth Report (Third Biennial) of the State Mineralogist, for the two years ending September 15, 1896, 726 pp., 93 illustrations, 1 map.  J. J. Crawford	
Chapters of the State Mineralogist's Report, Biennial Period, 1913–1914, Fletcher Hamilton:  **Mines and Mineral Resources; Amador, Calaveras and Tuolumne Counties,	
172 pp., paperMines and Mineral Resources, Colusa, Glenn, Lake, Marin, Napa, Solano,	
Sonoma and Yolo Counties, 208 pp., paperMines and Mineral Resources, Del Norte, Humboldt, and Mendocino	.50
Counties, 59 pp., paper**Mines and Mineral Resources, Fresno, Kern, Kings, Madera, Mariposa,	.25
Merced, San Joaquin and Stanislaus Counties, 220 pages, paper  Mines and Mineral Resources of Imperial and San Diego Counties,  113 pp., paper	.35
**Mines and Mineral Resources, Shasta, Siskiyou and Trinity Counties, 180 pp., paper	
Fourteenth Report of the State Mineralogist, for the Biennial Period 1913–1914, Fletcher Hamilton, 1915:	
A General Report on the Mines and Mineral Resources of Amador, Calaveras, Tuolumne, Colusa, Glenn, Lake, Marin, Napa, Solano, Sonoma, Yolo, Del Norte, Humboldt, Mendocino, Fresno, Kern, Kings, Madera, Mariposa, Merced, San Joaquin, Stanislaus, San Diego, Imperial, Shasta, Siskiyou, and Trinity Counties, 974 pp., 275 illustrations,	9.400
cloth Chapters of the State Mineralogist's Report, Biennial Period, 1915–1916,	2.00
Fletcher Hamilton:  **Mines and Mineral Resources, Alpine, Inyo and Mono Counties, 176 pp.,  paper	
Mines and Mineral Resources, Butte, Lassen, Modoc, Sutter, and Tehama Counties, 91 pp., paper	.50
Mines and Mineral Resources, El Dorado, Placer, Sacramento, and Yuba Counties, 198 pp., paper	.65
Mines and Mineral Resources, Monterey, San Benito, San Luis Obispo, Santa Barbara, and Ventura Counties, 183 pp., paper	.65
Mines and Mineral Resources, Los Angeles, Orange, and Riverside Counties,	.50
Mines and Mineral Resources, San Bernardino and Tulare Counties, 186 pp.,	.65
Fifteenth Report of the State Mineralogist, for the Biennial Period 1915-1916, Fletcher Hamilton, 1917:	
A General Report on the Mines and Mineral Resources of Alpine, Inyo, Mono, Butte, Lassen, Modoc, Sutter, Tehama, Placer, Sacramento, Yuba, Los Angeles, Orange, Riverside, San Benito, San Luis Obispo, Santa Barbara, Ventura, San Bernardino and Tulare Counties, 990 pp.,	
413 illustrations, cloth	3.75
Fletcher Hamilton: Mines and Mineral Resources of Nevada County, 270 pp., paper Mines and Mineral Resources of Plumas County, 188 pp., paper	.75 .50
Mines and Mineral Resources of Sierra County, 144 pp., paper	.50
Seventeenth Report of the State Mineralogist, 1920, Mining in California during 1920, Fletcher Hamilton; 562 pp., 71 illustrations, cloth	1.75

#### REPORTS—Continued.

REPORTS—Continued.	
Asterisks (**) indicate the publication is out of print.	Price
Eighteenth Report of the State Mineralogist, 1922, Mining in California, Fletcher Hamilton. Chapters published monthly beginning with January, 1922:	Trice
**January, **February, March, April, May, June, July, August, September,	10
October, November, December, 1922	Free
Fletcher Hamilton and Lloyd L. Root. January, February, March, September, 1923	Free
Chapters of Twentieth Report of the State Mineralogist, 'Mining in California,' Lloyd L. Root. Published quarterly. January, April, July, October, 1924, per copy	\$0.25
Chapters of Twenty-first Report of State Mineralogist, Mining in California.  Lloyd L. Root. Published quarterly. January, April, 1925, per copy Subscription, \$1.00 in advance (by calendar year, only).	.25
Chapters of State Oil and Gas Supervisor's Report:	
Summary of Operations—California Oil Fields, July, 1918, to March, 1919 (one volume)	Free
Summary of Operations—California Oil Fields. Published monthly, beginning April, 1919:	
**April, **May, June, **July, **August, **September, **October, November, **December, 1919	Free
January, February, March, April, **May, June, July, **August, September, October, November, December, 1920	Free
January, **February, **March, **April, May, June, **July, August, **September, **October, **November, **December, 1921 January, February, March, April, May, June, July, August, September,	Free
January, February, March, April, May, June, July, August, September, October, November, December, 1922	Free
January, February, March, April, May, June, July, August, September, October, November, December, 1923	Free
January, February, March, April, May, June, July, August, September, October, November, December, 1924  January, February, March, April, 1925	Free Free
BULLETINS.	
Asterisks (**) indicate the publication is out of print.	
**Bulletin No. 1. A Description of Some Desiccated Human Remains, by Winslow Anderson. 1888, 41 pp., 6 illustrations	
**Bulletin No. 3. Gas and Petroleum Yielding Formations of Central Valley of California, by W. L. Watts. 1894, 100 pp., 13 illustrations, 4 maps.	
**Bulletin No. 4. Catalogue of Californian Fossils, by J. G. Cooper, 1894, 73 pp., 67 illustrations. (Part I was published in the Seventh Annual	
**Bulletin No. 5. The Cyanide Process, 1894, by Dr. A. Scheidel. 140 pp., 46 illustrations	
Bulletin No. 6. California Gold Mill Practices, 1895, by E. B. Preston, 85 pp., 46 illustrations	.50
**Bulletin No. 7. Mineral Production of California, by Counties for the year 1894, by Charles G. Yale. Tabulated sheet	.00
**Bulletin No. 8. Mineral Production of California, by Counties for the year 1895, by Charles G. Yale. Tabulated sheet	
**Bulletin No. 9. Mine Drainage, Pumps, etc., by Hans C. Behr. 1896, 210 pp., 206 illustrations	
**Bulletin No. 10. A bibliography Relating to the Geology, Palæontology and Mineral Resources of California, by Anthony W. Vogdes. 1896, 121 pp.	
**Bulletin No. 11. Oil and Gas Yielding Formations of Los Angeles, Ventura and Santa Barbara counties, by W. L. Watts. 1897, 94 pp., 6 maps,	
**Bulletin No. 12. Mineral Production of California, by Counties for 1896, by Charles G. Yale. Tabulated sheet	

## BULLETINS—Continued.

Asterisks (**) indicate the publication is out of print.	
**Bulletin No. 13. Mineral Production of California, by Counties for 1897,	Price
by Charles G. Yale. Tabulated sheet*Bulletin No. 14. Mineral Production of California, by Counties for 1898, by Charles G. Yale	
**Bulletin No. 15. Map of Oil City Fields, Fresno County, by John H.  Means, 1899	
**Bulletin No. 16. The Genesis of Petroleum and Asphaltum in California, by A. S. Cooper. 1899, 39 pp., 29 illustrations	
**Bulletin No. 17. Mineral Production of California, by Counties for 1899, by Charles G. Yale. Tabulated sheet	
**Bulletin No. 18. Mother Lode Region of California, by W. H. Storms. 1900, 154 pp., 49 illustrations	
**Bulletin No. 19. Oil and Gas Yielding Formations of California, by W. L. Watts. 1900, 236 pp., 60 illustrations, 8 maps	
**Bulletin No. 20. Synopsis of General Report of State Mining Bureau, by W. L. Watts. 1901, 21 pp. This bulletin contains a brief statement of the progress of the mineral industry in California for the four years	
**Bulletin No. 21. Mineral Production of California by Counties, by Charles G. Yale. 1900. Tabulated sheet	
**Bulletin No. 22. Mineral Production of California for Fourteen Years, by Charles G. Yale. 1900. Tabulated sheet	
Bulletin No. 23. The Copper Resources of California, by P. C. DuBois, F. M. Anderson, J. H. Tibbits and G. A. Tweedy. 1902, 282 pp., 69 illustrations, and 9 maps	\$0.50
**Bulletin No. 24. The Saline Deposits of California, by G. E. Bailey. 1902, 216 pp., 99 illustrations, 5 maps	φυ.συ
**Bulletin No. 25. Mineral Production of California, by Counties, for 1901, by Charles G. Yale. Tabulated sheet	
**Bulletin No. 26. Mineral Production of California for the past Fifteen Years, by Charles G. Yale. 1902. Tabulated sheet	
**Bulletin No. 27. The Quicksilver Resources of California, by William Forstner. 1903, 273 pp., 144 illustrations, 8 maps	
**Bulletin No. 28. Mineral Production of California, for 1902, by Charles G. Yale. Tabulated sheet	
**Bulletin No. 29. Mineral Production of California for Sixteen Years, by Charles G. Yale. 1903. Tabulated sheet	
**Bulletin No. 30. Bibliography Relating to the Geology, Palæontology, and Mineral Resources of California, by A. W. Vogdes. 1903, 290 pp	
**Bulletin No. 31. Chemical Analyses of California Petroleum, by H. N. Cooper. 1904. Tabulated sheet**Bulletin No. 32. Production and Use of Petroleum in California, by Paul	
W. Prutzman. 1904, 230 pp., 116 illustrations, 14 maps**Bulletin No. 33. Mineral Production of California, by Counties, for 1903,	
by Charles G. Yale. Tabulated sheet*Bulletin No. 34. Mineral Production of California for Seventeen Years,	
by Charles G. Yale. 1904. Tabulated sheet**Bulletin No. 35. Mines and Minerals of California, by Charles G. Yale.	
1904, 55 pp., 20 county maps. Relief map of California**Bulletin No. 36. Gold Dredging in California, by J. E. Doolittle. 1905,	
**Bulletin No. 37. Gems, Jewelers' Materials, and Ornamental Stones of California, by George F. Kunz. 1905, 168 pp., 54 illustrations	
**Bulletin No. 38. Structural and Industrial Materials of California, by Wm. Forstner, T. C. Hopkins, C. Naramore and L. H. Eddy. 1906,	
**Bulletin No. 39. Mineral Production of California, by Counties, for 1904, by Charles G. Yale. Tabulated sheet	
**Bulletin No. 40. Mineral Production of California for Eighteen Years, by Charles G. Yale. 1905. Tabulated sheet	
**Bulletin No. 41. Mines and Minerals of California, for 1904, by Charles G. Yale. 1905, 54 pp., 20 county maps	

#### BULLETINS—Continued.

BULLETINS—Continued.	
Asterisks (**) indicate the publication is out of print.	Delas
**Bulletin No. 42. Mineral Production of California, by Counties, 1905, by	Price
Charles G. Yale. Tabulated sheet  **Bulletin No. 43. Mineral Production of California for Nineteen Years,	
**Bulletin No. 44. California Mines and Minerals for 1905, by Charles G. Yale. 1907, 31 pp., 20 county maps	
**Bulletin No. 45. Auriferous Black Sands of California, by J. A. Edman. 1907, 10 pp	
Bulletin No. 46. General Index of Publications of the California State Mining Bureau, by Charles G. Yale. 1907, 54 pp	\$0.30
**Bulletin No. 47. Mineral Production of California, by Counties, 1906, by Charles G. Yale. Tabulated sheet	
**Bulletin No. 48. Mineral Production of California for Twenty Years.  1906, by Charles G. Yale	
**Bulletin No. 49. Mines and Minerals of California for 1906, by Charles G. Yale. 34 pp	
Bulletin No. 50. The Copper Resources of California, 1908, by A. Hausmann, J. Kruttschnitt, Jr., W. E. Thorne and J. A. Edman, 366 pp.,	
74 illustrations. (Revised edition.) ***Bulletin No. 51. Mineral Production of California, by Counties, 1907, by	1.00
D. H. Walker. Tabulated sheet**Bulletin No. 52. Mineral Production of California for Twenty-one Years,	
**Bulletin No. 53. Mineral Production of California for 1907, with County	
Maps, by D. H. Walker, 62 pp.  **Bulletin No. 54. Mineral Production of California, by Counties, by D. H.  Walker, 1908 Polyheted cheet	
**Bulletin No. 55. Mineral Production of California for Twenty-two Years, by D. H. Walker, 1908. Tabulated sheet	Sec. 100 case Sec.
**Bulletin No. 56. Mineral Production for 1908, with County Maps and Mining Laws of California, by D. H. Walker. 78 pp	
**Bulletin No. 57. Gold Dredging in California, by W. B. Winston and Chas. Janin. 1910, 312 pp., 239 illustrations and 10 maps	
**Bulletin No. 58. Mineral Production of California, by Counties, by D. H. Walker, 1909. Tabulated sheet	
**Bulletin No. 59. Mineral Production of California for Twenty-three Years, by D. H. Walker, 1909. Tabulated sheet	
**Bulletin No. 60. Mineral Production for 1909, County Maps and Mining Laws of California, by D. H. Walker. 94 pp	
**Bulletin No. 61. Mineral Production of California, by Counties for 1910, by D. H. Walker. Tabulated sheet.	
**Bulletin No. 62. Mineral Production of California for Twenty-four Years, by D. H. Walker, 1910. Tabulated sheet*Bulletin No. 63. Petroleum in Southern California, by P. W. Prutzman.	
1912, 430 pp., 41 illustrations, 6 maps**Bulletin No. 64. Mineral Production for 1911, by E. S. Boalich. 49 pp	
**Bulletin No. 65. Mineral Production for 1912, by E. S. Boalich. 49 pp **Bulletin No. 66. Mining Laws of the United States and California. 1914,	
89 pp. **Bulletin No. 67. Minerals of California, by Arthur S. Eakle. 1914,	
**Bulletin No. 68. Mineral Production for 1913, with County Mans and	
**Bulletin No. 69. Petroleum Industry of California, with Folio of Maps	
(18 by 22), by R. P. McLaughlin and C. A. Waring. 1914, 519 pp., 13 illustrations, 83 figs. [18 plates in accompanying folio.]	
Mining Laws, 184 pp.	
**Bulletin No. 71. Mineral Production for 1915, with County Maps and Mining Laws, by Walter W. Bradley. 193 pp., 4 illustrations	
Bulletin No. 72. The Geologic Formations of California, by James Perrin Smith. 1916, 47 pp	.25

#### BULLETINS-Continued.

	Asterisks (**) indicate the publication is out of print.
- \$2 -	Reconnaissance Geologic Map (of which, Bulletin 72 is explanatory) in 23 colors. Scale: 1 inch equals 12 miles. Mounted
E	278 pp., 26 illustrations
	Bulletin No. 76. Manganese and Chromium in California, by Walter W
-	Bradley, Emile Huguenin, C. A. Logan, W. B. Tucker and C. A. Waring, 1918. 248 pp., 51 illustrations, 5 maps, paperBulletin No. 77. Catalogue of Publications of California State Mining
. F	Bureau, 1880–1917, by E. S. Boalich. 44 pp., paper———————————————————————————————————
. :	77 photographs and 42 plates (colored and line cuts), cloth————————————————————————————————————
,	(In preparation.)  Bulletin No. 81. Foothill Copper Belt of California. (In preparation.)  **Bulletin No. 82. Second Annual Report of the State Oil and Gas Supervisor, for the fiscal year 1916–1917, by R. P. McLaughlin, 1918. 412 pp. 31 illustrations, cloth
	Bulletin No. 83. California Mineral Production for 1917, with County
	Maps, by Walter W. Bradley. 179 pp., paper**Bulletin No. 84. Third Annual Report of the State Oil and Gas Supervisor, for the fiscal year 1917–1918, by R. P. McLaughlin, 1918. 617 pp., 28 illustrations, cloth
_	**Bulletin No. 85. Platinum and Allied Metals in California, by C. A. Logan 1919. 10 photographs, 4 plates, 120 pp., paper Bulletin No. 86. California Mineral Production for 1918, with County
. F	**Bulletin No. 87. Cammercial Mineral Production for 1916, with County  approximately 1919. 212 pp., paper  **Bulletin No. 87. Commercial Minerals of California, with notes on their uses, distribution, properties, ores, field tests, and preparation for market, by W. O. Castello, 1920. 124 pp., paper  Bulletin No. 88. California Mineral Production for 1919, with County
. F	Maps, by Walter W. Bradley, 1920. 204 pp., paper**Bulletin No. 89. Petroleum Resources of California, with Special Reference to Unproved Areas, by Lawrence Vander Leck, 1921. 12 figures, 6 photographs. 6 maps in pocket, 186 pp., cloth
F	Maps, by Walter W. Bradley, 1921. 218 pp., paperBulletin No. 91. Minerals of California, by Arthur S. Eakle, 1923, 328 pp.,
	cloth Bulletin No. 92. Gold Placers of California, by Chas. S. Haley, 1923. 167 pp., 36 photographs and 7 plates (colored and line cuts, also geologic map), cloth
	Extra copies of the Geologic Map (in 4 colors)Bulletin No. 93. California Mineral Production for 1922, by Walter W.
	Bradley, 1923  Bulletin No. 94. California Mineral Production for 1923, by Walter W.
- -	Bradley, 1924
	PRELIMINARY REPORTS.

Asterisks (**) indicate the publication is out of print.

# PRELIMINARY REPORTS—Continued. Asterisks (**) indicate the publication is out of print.

Asterisks (**) indicate the publication is out of print.	Price
Preliminary Report No. 3. Manganese and Chromium, 1917. By E. S. Boalich. 32 pp	11100
Preliminary Report No. 4. Tungsten, Molybdenum and Vanadium. By E. S. Boalich and W. O. Castello, 1918. 34 pp. Paper	Free
Preliminary Report No. 5. Antimony, Graphite, Nickel, Potash, Strontium and Tin. By E. S. Boalich and W. O. Castello, 1918, 44 pp. Paper	Free
Preliminary Report No. 6. A Review of Mining in California During 1919.	
Fletcher Hamilton, 1920. 43 pp. Paper**Preliminary Report No. 7. The Clay Industry in California. By E. S.	Free
Boalich, W. O. Castello, E. Huguenin, C. A. Logan, and W. B. Tucker,	
1920. 102 pp. 24 illustrations. Paper	
Preliminary Report No. 8. A Review of Mining in California During	
1921, with Notes on the Outlook for 1922. Fletcher Hamilton, 1922. 68 pp. Paper	
MISCELLANEOUS PUBLICATIONS.	
Asterisks (**) indicate the publication is out of print.	
**First Annual Catalogue of the State Museum of California, being the collection made by the State Mining Bureau during the year ending April 16, 1881. 350 pp	
**Catalogue of books, maps, lithographs, photographs, etc., in the library of	
the State Mining Bureau at San Francisco, May 15, 1884. 19 pp **Catalogue of the State Museum of California, Volume II, being the collec-	
tion made by the State Mining Bureau from April 16, 1881, to May 5,	
1884. 220 pp	
**Catalogue of the State Museum of California, Volume III, being the collection made by the State Mining Bureau from May 15, 1884, to March 31,	
1887. 195 pp	
tion made by the State Mining Bureau from March 30, 1887, to August	
20, 1890. 261 pp**Catalogue of the Library of the California State Mining Bureau, September	
1, 1892. 149 pp	
**Catalogue of West North American and Many Foreign Shells with Their	
Geographical Ranges, by J. G. Cooper. Printed for the State Mining Bureau, April, 1894	
**Report of the Board of Trustees for the four years ending September, 1900.	
15 pp. PaperBulletin. Reconnaissance of the Colorado Desert Mining District. By	
Stephen Bowers, 1901. 19 pp. 2 illustrations. Paper	Free
Commercial Mineral Notes. A monthly mimeographed sheet, beginning	
April, 1923	Free
MAPS.	
Registers of Mines With Maps.	
Asterisks (**) indicate out of print.	
**Register of Mines, with Map, Amador County	
**Register of Mines, with Map, Butte County	and only pay on
**Register of Mines, with Map, Calaveras County*  Register of Mines, with Map, El Dorado County	
**Register of Mines, with Map, Inyo County	
**Register of Mines, with Map, Kern County	
**Register of Mines, with Map, Lake County**Register of Mines, with Map, Mariposa County	
**Register of Mines, with Map, Nevada County	
**Register of Mines, with Map, Placer County	
**Register of Mines, with Map, Plumas County  **Register of Mines, with Map, San Bernardino County	
The state of the s	

#### MAPS—Continued.

Asterisks (**) indicate the publication is out of print.	
**Register of Mines, with Map, San Diego County	Price
Register of Mines, with Map, Santa Barbara County	
**Register of Mines, with Map, Shasta County	
**Register of Mines, with Map, Sierra County  **Register of Mines, with Map, Siskiyou County	
**Register of Mines, with Man Trinity County	
**Register of Mines, with Map, Tuolumne County	
Register of Mines, with Map, Yuba County	
and the state of t	
OTHER MAPS.	
Asterisks (**) indicate the publication is out of print.	
**Map of California, Showing Mineral Deposits (50 x 60 in.)—	
Map of Forest Reserves in California—  Mounted	\$0.50
**Unmounted	
**Mineral and Relief Map of California	
**Map of El Dorado County, Showing Boundaries, National Forests **Map of Madera County, Showing Boundaries, National Forests	
**Map of Placer County, Showing Boundaries, National Forests	
**Map of Shasta County, Showing Boundaries, National Forests	
**Map of Sierra County, Showing Boundaries, National Forests*Map of Siskiyou County, Showing Boundaries, National Forests	
**Map of Tuolumne County, Showing Boundaries, National Forests	
**Map of Mother Lode Region	
**Map of Desert Region of Southern California	.20
Map of Copper Deposits in California	.05
**Map of Calayeras County	
**Map of Plumas County*Map of Trinity County	.25
Map of Tuolumne County	.25
Geological Map of Inyo County. Scale 1 inch equals 4 miles	.60
Map of California accompanying Bulletin No. 89, showing generalized classification of land with regard to oil possibilities. Map only, without	
Bulletin	.25
Geological Map of California, 1916. Scale 1 inch equals 12 miles. As accurate and up-to-date as available data will permit as regards topog-	
raphy and geography. Shows railroads, highways, post offices and other	
towns. First geological map that has been available since 1892, and	
shows geology of entire state as no other map does. Geological details lithographed in 23 colors. Mounted	2.50
Topographic Map of Sierra Nevada Gold Belt, showing distribution of	2.00
auriferous gravels. In 4 colors	.50
OIL FIELD MAPS.	
These maps are revised from time to time as development work	
advances and ownerships change.	
Map No. 1-Sargent, Santa Clara County	.50
Map No. 2—Santa Maria, including Cat Canyon and Los Alamos————————————————————————————————————	.75
Map No. 4—Whittier-Fullerton, including Olinda, Brea Canyon, Puente	.75
Hills, East Coyote and Richfield	.75
Map No. 5—Whittier-Fullerton, including Whittier, West Coyote, and Montebello	.75
Map No. 6—Salt Lake, Los Angeles County	.75
Map No. 7—Sunset and San Emido and Kern County	.75
Map No. 8—South Midway and Buena Vista Hills, Kern County	.75 .75
Map No. 10—Belridge and McKittrick, Kern County	.75

1.00

		OIL FIELD MAPS—Continued.	Pr
Мар	No.	11-Lost Hills and North Belridge, Kern County	
Map	No.	12—Devils Den, Kern County	
Map	No.	13-Kern River, Kern County	\$0
Map	No.	14—Coalinga, Fresno County	1
Map	No.	15—Elk Hills, Kern County————————————————————————————————————	
		16—Ventura-Ojai, Ventura County	
		17—Santa Paula-Sespe Oil Fields, Ventura County	
		18—Piru-Simi-Newhall Oil Fields	
-		19—Arroyo Grande, San Luis Obispo County	
-		20—Long Beach Oil Field	1
Map	No.	21—Portion of District 4, Showing Boundaries of Oil Fields, Kern	
		and Kings counties	
Мар	No.	22—Portion of District 3, Showing Oil Fields, Santa Barbara	
		County	
Мар	No.	23—Portion of District 2, Showing Boundaries of Oil Fields,	
	B.T.	Ventura County	
мар	No.	24—Portion of District 1, Showing Boundaries of Oil Fields, Los	
	37.	Angeles and Orange counties	
wap	NO.	26—Huntington Beach Oil Field	
		27—Santa Fe Springs Oil Field	
Map	NO.	28—Torrance, Los Angeles County	

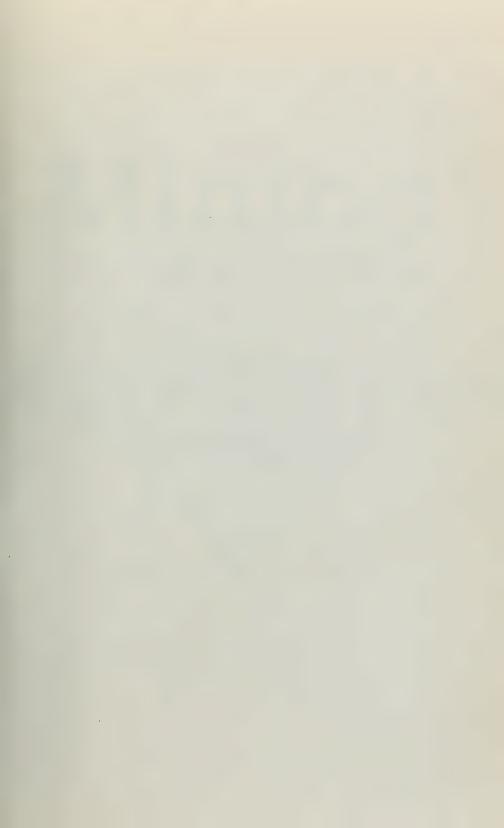
#### DETERMINATION OF MINERAL SAMPLES.

Map No. 29—Dominguez, Los Angeles County_____

Map No. 30-Rosecrans, Los Angeles County----

Samples (limited to three at one time) of any mineral found in the state may be sent to the Bureau for identification, and the same will be classified free of charge. No samples will be determined if received from points outside the state. It must be understood that no assays, or quantitative determinations will be made. Samples should be in lump form if possible, and marked plainly with name of sender on outside of package, etc. No samples will be received unless delivery charges are prepaid. A letter should accompany sample, giving locality where mineral was found and the nature of the information desired.





#### THE STATE MINING BUREAU

CORDIALLY INVITES YOU TO VISIT
ITS VARIOUS DEPARTMENTS MAINTAINED
FOR THE PURPOSE OF FURTHERING
THE DEVELOPMENT OF THE

#### MINERAL RESOURCES OF CALI-FORNIA

At the service of the public are the scientific reference library and reading room, the general information bureau, the laboratory for the free determination of mineral samples found in the state, and the largest museum of mineral specimens on the Pacific Coast. The time and attention of the State Mineralogist, as well as of his technical staff, are also at your disposal.

Office hours: 9 a.m. to 5 p.m. daily. Saturday, 9 a.m. to 12 m.

LLOYD L. ROOT, State Mineralogist.

Third floor, Ferry Building, San Francisco, Cal.
Branch Offices: Pacific Finance Building, Los
Angeles; Chamber of Commerce Building,
Sacramento, Bakersfield, Taft, Coalinga
Santa Maria and Santa Paula.

# Mining in California



PUBLISHED QUARTERLY

CALIFORNIA STATE MINING BUREAU

> FERRY BUILDING SAN FRANCISCO

#### CALIFORNIA STATE MINING BUREAU.

#### EXECUTIVE AND TECHNICAL STAFF

LLOYD L. ROOT State Mineralogist

WALTER W. BRADLEY
Deputy State Mineralogist

#### MINING DIVISION

C. A. LOGAN, District Mining Engineer	-	-	-	-	Sacramento
C. McK. Laizure, District Mining Engineer -	-	-	-	-	San Francisco
W. BURLING TUCKER, District Mining Engineer	-	-	-	-	Los Angeles
FRANK SANBORN, Mineral Technologist	-	•	•	-	San Francisco
W. F. DIETRICH, Ceramic Engineer	-			-	San Francisco

#### DEPARTMENT OF PETROLEUM AND GAS

R. D. Bush, State Oil and Gas Supervisor - - - - San Francisco

Note.—A detailed report of the activities of the Department of Petroleum and Gas is issued monthly by the State Mining Bureau, entitled 'Summary of Operations, California Oil Fields.'

#### CALIFORNIA STATE MINING BUREAU

FERRY BUILDING, SAN FRANCISCO

LLOYD L. ROOT

State Mineralogist

Vol. 21

OCTOBER, 1925

No. 4

#### CHAPTER OF

# REPORT XXI OF THE STATE MINERALOGIST

COVERING

### MINING IN CALIFORNIA

AND THE

#### ACTIVITIES OF THE STATE MINING BUREAU



CALIFORNIA STATE PRINTING OFFICE JOHN E. KING, State Printer SACRAMENTO, 1925



#### CONTENTS.

DISTRICT REPORTS OF MINING ENGINEERS	Page 413
Sacramento Field Division	413
Siskiyou County	413
San Francisco Field Division	499
San Luis Obispo County	499
Los Angeles Field Division	539
Santa Barbara County	539
Oil Field Development Operations	563
SPECIAL ARTICLES	568
Directory of California Foundries	568
ADMINISTRATION DIVISION	573
DIVISION OF MINERALS AND STATISTICS	574
Statistics	574
Museum	588
Laboratory	588
LIBRARY	589
PRODUCERS AND CONSUMERS	594
EMPLOYMENT SERVICE	595
BUREAU PUBLICATIONS	I
INDEX	597







#### PREFACE.

The State Mining Bureau is maintained for the purpose of assisting in all possible ways in the development of California's mineral resources.

As one means of offering tangible service to the mining public, the State Mineralogist for many years has issued an annual or a biennial report reviewing in detail the mines and mineral deposits of the various counties.

The weak point in work of this character has been that the results of field investigations were so long in preparation that they had lost much of their usefulness by the time they finally appeared in print.

As a progressive step in advancing the interests of the mineral industry, publication of the Annual Report of the State Mineralogist in the form of monthly chapters was begun in January, 1922, and continued until March, 1923.

Owing to a lack of funds for printing, quarterly publication was

begun in September, 1923.

For the same reason, beginning with the January, 1924, issue, it has been necessary to charge a subscription price of \$1 per calendar year, payable in advance; single copies, 25 cents apiece. 'Mining in California' will continue to be sent without charge to our exchange list, including schools and public libraries, as are also other publications of the State Mining Bureau.

Pages are numbered consecutively throughout the year and an index to the complete reports is included annually in the closing number.

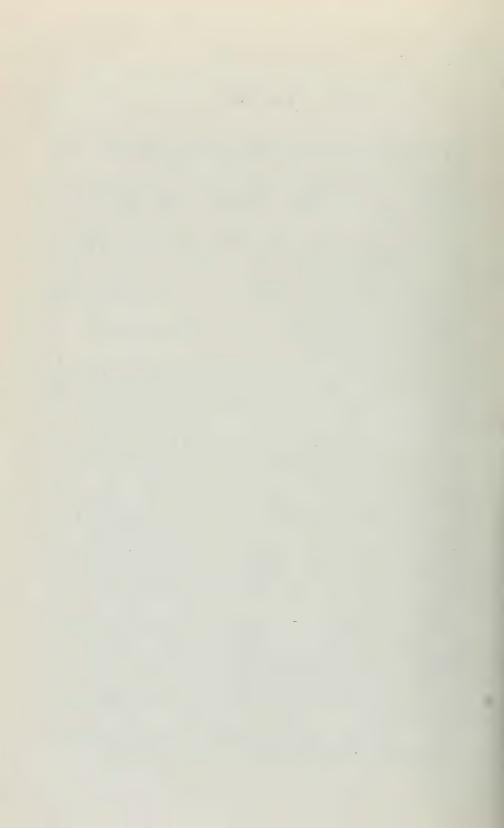
Such a publication admits of several improvements over the old method of procedure. Each issue contains a report of the current development and mining activities of the state, prepared by the district mining engineers. Special articles dealing with various phases of mining and allied subjects by members of the staff and other contributors are included. Mineral production reports formerly issued only as an annual statistical bulletin are published herein as soon as returns from producers are compiled. The executive activities, and those of the laboratory, museum, library, employment service and other features with which the public has had too little acquaintance also are reported.

While current activities of all descriptions will be covered in these chapters, the Bureau will not discontinue its practice of issuing from time to time technical reports on special subjects. A list of such reports now available is appended hereto, and the names of new bulletins will be added in the future as they are completed.

The chapters will be subject to revision, correction and improvement. Constructive suggestions from the mining public will be gladly received,

and are invited.

The one aim of the Mining Bureau is to increase its usefulness and to stimulate the intelligent development of the wonderful, latent resources of the State of California.



#### DISTRICT REPORTS OF MINING ENGINEERS.

In 1919-1920 the Mining Department was organized into four main geographical divisions, with the field work delegated to a mining engineer in each district working out from field offices that were established in Redding, Auburn, San Francisco and Los Angeles, respectively.

This move brought the Bureau into closer personal contact with operators, and it has many advantages over former methods of con-

ducting field work.

To continue this system most effectively with the limited funds available for the present biennium, the Redding and Auburn field offices were

consolidated and moved to Sacramento on June 1, 1923.

The boundaries of each district were adjusted and the counties now included in each of the three divisions, and the locations of the branch offices, are shown on the accompanying outline map of the state. (Frontispiece.)

Reports of mining activities and development in each division, prepared by the district engineer, will continue to appear under the proper

field division heading.

Although the petroleum industry is but little affiliated with other branches of mining, oil and gas are among the most valuable mineral products of California, and a report by the State Oil and Gas Supervisor on the current development and general conditions in the state's oil fields is included under this heading.

#### New County Reports.

The series of separate reports on the mines and mineral resources of the different counties, that together comprise the State Mineralogist's Reports XIV to XVII, inclusive, in the case of many of the counties have become exhausted. Those still in stock are in need of revision. It has been thought advisable, therefore, beginning with the January, 1925, issue of 'Mining in California,' to make the district engineers' reports in the form of a complete general report on the mines and mineral resources in one or more of the counties in each district.

This program will be followed as near as possible in succeeding numbers of the quarterly until each county in the state has been covered.

#### SACRAMENTO FIELD DIVISION.

C. A. LOGAN, Mining Engineer,

SISKIYOU COUNTY.

#### Foreword and Acknowledgment.

The following report is based upon field work carried on from July to November, 1925, during which time the mines of Trinity County were also visited and there were numerous interruptions necessitated by routine office work.

The aim of the present season's work was to cover all mining activity not heretofore accurately recorded in the Bureau's reports, and to present a comprehensive idea in one report of the county's mineral resources. It would be physically impossible for an engineer to visit

all prospects in this county in a year's time, spending every day in the field, as the mineralized area is too extensive and traveling is necessarily slow in such rugged country. At the same time, detailed notes are presented on many properties not previously described, the idea being to supply details of geology for a number of properties that may serve as types, and avoid repetition of similar details for numerous mines of the same kind. That a certain property is covered in considerable detail herein, while a neighboring property of apparently equal interest receives less space, is due to the fact that in the first case the writer may have received better co-operation from owners, or accidental circumstances, arising at the time of visit may have made it possible to cover one in greater detail than another. The sparsely settled condition of the mining sections (there being often only one inhabitant in many square miles) and the number of nonresident owners, increase the difficulty of getting accurate details. It should also be noted that since few of the mines and prospects are patented, and fewer still are carried on the real property tax rolls, the ownership and other details regarding many idle properties were not obtainable with absolute certainty in the time available.

The writer wishes to acknowledge with thanks the assistance rendered by many local miners and property owners, particularly Messrs. H. C. Cutting, M. J. Conover, W. J. Brown and the late Reeves Davis, all of Happy Camp; Frank and Dave Morgan, Gottville; J. V. McTimmonds and Joe Martin, Seiad Valley; H. J. Barton, Yreka; E. W. Morgan, Oak Bar; C. B. Kay, Ager; L. J. Joubert, A. J. Ball, E. Jacquemart, Judge Judin Johnson, Ike Cleaver and others of Sawyers Bar; Scott Howard of Sacramento, and numerous others who cooperated by sup-

plying valuable information.

A bibliography of publications on the mineral resources and geology of this county will be found at the end of the report.

#### Geography.

Siskiyou County, one of the northernmost in the state, borders on the state of Oregon for a distance of 116 miles and is from 60 to 70 miles long, being bounded on the west by the coast counties of Humboldt and Del Norte, on the south by Trinity and Shasta, and on the east by Modoc. The region of interest to the miner is the portion lying west of the lava sheet, the western boundary of which coincides roughly with the Oregon branch of the Southern Pacific Railroad, traversing the county from north to south a little east of its center. The total area of the county is 6256 square miles and the population of 18,500 is concentrated almost entirely along the railroad, at the county seat, and in Scott Valley.

The western mineral-bearing section is a succession of high mountains and deep canyons, forming the drainage basin of Klamath River and its tributaries. The Klamath follows a crooked westerly course across the northern part of the county, receiving Shasta and Scott rivers, the principal streams draining the central part of the county; then turning south near Happy Camp where Indian Creek enters, it flows through a deep canyon, receiving the waters of Salmon River at Somes Bar on the southwest county line. The only level land in this region is in Scott Valley, lying at an elevation of 3000 feet along the middle course of Scott River; a few gravel bars along the Klamath River between

Hornbrook and Happy Camp, and such small valleys as those at the mouths of Seiad and Indian creeks, which accommodate the settlements

of Seiad and Happy Camp.

Until recently, the more remote mining districts have been handicapped by lack of roads. The Klamath River road from Hamburg Bar to Orleans has only lately been completed. The Salmon River country has had only one outlet up to the present year, and that is normally closed by snow from November to April. Late in 1925, however, a new road, built by the United States government, was completed from Forks of Salmon to the Klamath River road at Somes Bar, and when the balance of the road from Martins Ferry to the coast is improved, this will make both districts accessible all the year, this latter section being difficult and muddy in wet weather where it crosses Humboldt The older districts are all reached by fairly good roads. Callahan is 41 miles from Yreka and the same distance from Gazelle. Quartz Valley is 30 miles from Yreka, and Scott Bar is 48 miles from the county seat via Fort Jones or 44 miles via the Klamath River road. Cottonwood and Humbug are only a few miles west of the Pacific highway. The mines near the Klamath River as far west as Oak Bar are reached by the well improved section of highway forming the easterly 30 miles of the Klamath River road.

The most active mining districts at present are the Salmon River country, and the region tributary to the Klamath River from Hornbrook to Cottage Grove. These are discussed more fully in separate para-

graphs.

#### GEOLOGY AND MINERAL RESOURCES.

The county has been celebrated in the past particularly because of its placer mines. Geologically these placer deposits differ from those in the east-central part of the state. In northwestern California the ancient auriferous gravels most actively mined are found in the form of a succession of terrace or bench deposits left at successively lower levels on the sides of the present river canyons as the streams cut downward to their present beds. The flows of lava and volcanic mud. which occurred in the Sierra Nevada during the Tertiary, and which preserved for the modern miner the ancient river channels, are lacking in this region. The terrace deposits of Siskiyou and adjacent counties date from Quaternary to Recent time. They parallel the present streams and have practically the same grades, and such earth movements as have occurred since their deposition have been probably slow and widespread, tending to rejuvenate the streams and accelerate their powers of erosion. The downward cutting rivers enriched their gravels by erosion of the ancient gold-bearing schists and the pre-existing river and shore gravels of the 'Cretaceous Island' of northern California. This Cretaceous island embraced practically all of western Siskivou County, this area having been elevated above the sea since very early ages, and being devoid of Cretaceous or later marine sedimentary rocks west of the vicinity of Cottonwood Creek. The chief tributaries which themselves have been the scene of placer mining and have contributed gold to the Klamath, are Scott River, Salmon River, tributaries of Shasta River, and Humbug Creek, all entering from the south, and Indian, Beaver and Cottonwood creeks from the north.

#### Scott River Region.

On Scott River early day placer mining camps flourished on the South Fork around Callahan and at Scott Bar, 3 to 4 miles from the mouth of the main stream. There is still considerable unworked gravel near Callahan. (See under dredging.) This is characterized by lack of grade and dump, and heavy boulders in places. The small area at Scott Bar was extremely rich. There remains quite an area of placer ground at the Roxbury Mine, and some high ground on both sides of Scott River, similar to the Quartz Hill diggings, where auriferous seams and veins of quartz are being worked by the hydraulic process. This seam belt has been considered responsible for the enrichment of the river below its crossing. It is noteworthy that from Callahan to Scott Bar the river itself has yielded little gold, but considerable profitable mining has been done in Quartz Valley, an arm of Scott Valley west of the present river. The gold on the west side of this valley was derived from an ancient channel, probably of Scott River, remnants of which are to be seen at Little Sniktaw Valley, and it can be traced southeastward upstream past Shackelford and Mill creeks, the Pinery workings (formerly Stockton Gravel Mining Company) and old Etna Mills. In places this channel has been entirely eroded into the valley, but elsewhere it is in place and has been worked on a small scale only, because of lack of water. It is a large channel with rather heavy, tight Another class of deposit mined here was derived from local crosion of auriferous seams and small veins in the hills separating Quartz Valley from Oro Fino and Scott Valley. Quartz Valley has interesting possibilities for placer mining vet, but as the ground mentioned near its lower end has not been tested, it is not known whether it could be dredged, or would have to be worked by drifting. The ground is probably quite deep.

#### North Central Region.

Humbug district, northwest of Yreka and south of Klamath River; Cottonwood district, north of the Klamath, and quartz properties in the vicinities of Yreka, Fort Jones, Cherry Creek and other small quartz and pocket mining districts, may all be grouped together geologically. They occupy an area of 'Paleozoic Metamorphics' which includes very old rocks, the youngest of which may be Carboniferous and the oldest Cambrian, but which can not be definitely placed in the geologic column because of a lack of fossils. Both the igneous and originally sedimentary members of this 'catch-all' classification have been altered. Limestone, slate, some jasper, quartz porphyry, diorite, diabase, hornblende schists, and great masses of serpentine occur. Paleozoic metamorphics have been compressed and show schistosity generally striking north to northeast and dipping east. Some of the principal veins follow this same strike and dip. There have been several subsequent minor movements, indicated by faults, shear zones and narrow veins and seams of quartz, striking in different directions. These in many cases faulted the earlier veins, as at the Hazel Mine. Many of the smaller pockety deposits are associated with intrusives such as diabase. In the Humbug district, some good ores were worked in serpentine, the principal mines having been the Boyle, Mountain Belle and Spencer. In general the work has been superficial. The best known

mines in this entire region are the Morrison and Carlock, in Quartz Valley district, 4 miles northwest of Greenview, and the Hazel Mine southwest of Hornbrook. The former was being unwatered in the autumn of 1925, after many years idleness, and early renewal of work was planned at the Hazel.

Placer mining in this region has been on a small scale in later years, due to exhaustion of the more accessible ground and the protracted shortage of water. Developments in dredging are mentioned under

that heading.

From Cottonwood Creek southward along Shasta Valley, and past Yreka, extend the ancient sedimentary deposits flanking on the east what was formerly the so-called 'Cretaceous Island,' previously mentioned. These beds consist of clay shales, sandstones, and shore gravels or conglomerates. The shale and sandstone contain beds of coal, and some of the beds are remarkably rich in shell remains and casts. This series in the region of the coal workings south of Ager. dips east 23° to 40°, the former figure being nearer the normal dip. These beds have been broken by a series of basaltic intrusions which show in knolls throughout the valley. The conglomerate was cut by the Klamath River and its nearby small tributaries in the region of Hornbrook and Cottonwood Creek, and was extensively eroded. This conglomerate was gold bearing and contributed probably most of the gold mined from the placers of Cottonwood, Rancheria, and other nearby creeks, and the immediate section of the river. Eastward of the conglomerate, the gravels of the Klamath River are said to be barren. A very interesting detailed account of this gold-bearing conglomerate written by R. L. Dunn, appeared in the Twelfth Report of the State Mineralogist, pages 459-471. The placers of the Cottonwood region, including Rancheria Creek, are estimated to have vielded about \$4,000,000. According to figures of yield reported by Dunn in the above paper, from workings then being mined, the conglomerate in the Blue Gravel Mine yielded 60 cents per square foot of bedrock when hydraulicked, this being only a part of the gold content, due to loss in the unbroken masses of conglomerate passing over the dump. The portion next the bedrock, when worked in an arrastra, paid 88 cents per square foot of bedrock. The conglomerate is overlain by Cretaceous sediments. The easterly area of sandstone and shale has been classified as Tertiary. In recent years the Henry Bradley Mine near Hornbrook has been operated in the conglomerate. At present the coal south of Ager is being prospected by drilling. Several abortive attempts have been made to bring in oil wells in this vicinity and southward. Gas (probably dry marsh gas) was reported from a well 3½ miles south of Montague on the road to Grenada, and gas and alkaline water came from another shallow well. Six miles southeast of Montague, in the valley of Little Shasta River, some fresh water springs have been observed to emit gas.

All the north-central portion of the county, as described above, is accessible by roads from Yreka and other nearby points on the Pacific highway. Yreka, the county seat, is 286 miles north of Sacramento by paved highway. The entire region is served with electric power by California-Oregon Power Company. Timber is lacking in the Shasta Valley section, but is obtainable in the western part of the area. The

elevation of this region ranges from 2000 feet to 5000 feet and there is some snowfall in all parts of it.

#### Klamath River District.

Until a few years ago the terrace deposits and bars along the Klamath River, and the placers along several of its tributaries, were the scene of the principal mining operations in the northwestern part of the county.

The country tributary to the Klamath on both sides remains for the most part difficult of access. The road following the river from the Pacific highway near Hornbrook to Martins Ferry, and climbing over the Bald Hills of Humboldt County, to a connection at Orick with the coast highway, has been completed only during the past two years. It is 76 miles from Hornbrook to Happy Camp over this road, and half of this is one-way road, the section of 30 miles from Hamburg Bar to Happy Camp being in such condition as to discourage travel. The maintenance of this road will be taken over by the State Highway Commission on January 1, 1926, and it is hoped some work will be done to improve it, at least by making numerous new turn-outs. For a distance of 120 miles from near Hornbrook to Somes Bar, this road follows the course of the Klamath River in this county and makes accessible one of the most extensive mining regions of the state. While the smaller and more easily worked placers along the river have been mined, there remain many terrace gravel deposits of interest to the hydraulic miner and numerous low bars offering possibilities for small scale drift mining operations. The gold quartz veins have not yet been prospected far enough to permit a fair opinion of their possibilities, but some very promising showings are being made. area from the river northward to the Oregon state line and westward to Del Norte County, comprising many separate isolated districts, may be classed as the base metal district. At the west end, in the Preston Peak country, are numerous small copper prospects, now all idle. The Buzzard Hill Mine on the south and the Grey Eagle property north of Happy Camp mark a valuable copper mining district, sufficient work having been done to prove large orebodies in the latter mine. Quicksilver ores occur along the watersheds of Beaver Creek and Empire Creek, and copper and zinc ores have been noticed in the latter locality. From Indian Creek eastward to the railroad a number of gold quartz mines, mostly of pockety nature, have been opened. Prospecting and development of such properties is now going on along the upper courses of Indian, Thompson, Horse, Beaver and other creeks. On Independence Creek, 14 miles south of Happy Camp the Independence Mine has lately been making a fine showing of phenomenally rich gold specimen ore.

The Klamath River district as a whole is well supplied with standing timber and water for mining purposes. While the people of California have lately forbidden the building of dams in the Klamath River, the question of utilizing waters of the river for hydro-electric power generation is complicated by the matter of jurisdiction, most of this mining region being in the national forest, and to a certain extent

under federal control.

#### SACRAMENTO FIELD DIVISION.

#### Salmon River District.

This district has been the most productive, and remains the most active and important gold mining area of the county. It embraces the drainage of Salmon River, an area of about 800 square miles, including many formerly productive quartz mines and placer deposits, the latter exploited in later years almost entirely by the hydraulic process. Considerable quartz prospecting is going on, and there is also a revival of hydraulic mining, which for several years had been hampered by shortage of water. A good water season the past winter, with the hope of others to follow, and the successful operation of a few properties, have encouraged other operators to spend considerable money in equipping and rehabilitating their placer properties, and if there is a good water supply, the season of 1925–26 will be the most productive in many years.

The principal mining camps of the district are Sawyers Bar, on the North Fork of Salmon River 55 miles by road from the railroad at Gazelle, and the same distance from Yreka, the county seat; and Forks of Salmon, at the junction of the north and south forks of the river, 17 miles by road west of Sawyers Bar. Between Etna and Sawyers Bar, a distance of 25 miles, the road passes over the Salmon Mountains at an elevation of 5929 feet, and the heavy snowfall in normal years prevents travel by automobiles or wagons into the district during about four months of winter. A new wagon road along the Salmon River from Forks of Salmon connecting with the Klamath River road at Somes Bar, has been completed the present season, and gives this district an outlet to the coast system of highways via Orleans.

The more important placer mining operations are confined to the benches, back channels and bars of the North Fork of Salmon River between Sawyers Bar and Forks of Salmon, and to Eddys Gulch, a tributary of north fork entering it from the south at Sawyers Bar. There are also unworked placer deposits in Whites Gulch, a tributary of north fork entering it three miles east of Sawyers Bar; on the south fork in the vicinity of Cecilville and Forks of Salmon, on the main river down stream from the latter camp and some small areas on the tributaries near the main branches of the river.

Quartz mining in the past, and the prospecting and development operations at present, are confined mostly to two areas, one of black slaty schists and associated altered intrusives (closely similar to the Calaveras slates of the Mother Lode country), which extend across the heads of Eddys Gulch and Whites Gulch and southwestward past Black Bear, the other an area in the higher mountains on the headwaters of Russian Creek, where high grade ores are found in quartz veins and stringers along shear zones in black schists and muscovite schists. The geology of the deposits is more fully dealt with under the descriptions of individual properties.

There are only two or three small areas of a few acres each of arable land along the Salmon River, the balance of the district being an elevated mountain region, deeply dissected by the streams whose beds lie from 2000 to 4500 feet below the surrounding summits, so that the

traveler is constantly climbing.

There is a good supply of timber for all mining purposes in this district. Water is available in the numerous creeks and gulches and in the Salmon River, in quantity ample for hydraulic and quartz mining, and in some places under conditions favoring hydro-electric power installations. The possession of these natural resources, and an exceptionally healthful climate, help to discount the remoteness of the district. The main North Fork of Salmon River has a grade of about 51 feet per mile from Sawyers Bar to Forks of Salmon, and the south fork 40 feet per mile. Electric power was brought in from Scott Valley to the Victory Mine during the past summer, and from the nearest point on this line, only a few miles of additional pole line would be needed to put power on all the mines at the heads of Whites and Eddys gulches.

The placers of the North Fork of Salmon River, in a distance of 17 miles between Sawyers Bar and Forks of Salmon have made an estimated production of \$25,000,000 in gold. The sources of this were the numerous gold-bearing veins of the basin drained by Salmon River and its tributaries, most important of which were the last two named gulches, Russian Creek, and the south fork below the mouth of Black

Bear Creek.

#### Elliott Creek District.

This district is on the north side of the Siskiyou mountains, the creek being a tributary of Applegate River. The principal property is the Blue Ledge Copper Mine, whose claims extend through the north central part of T. 47 N., R. 11 W., and the south central part of T. 48 N., R. 11 W. There are some other copper claims also in the district, and a few placer mines along Elliott Creek. This region is reached by road from Jacksonville, Oregon, 33 miles northeast.

#### Other Minerals.

Among the minerals found in this county, and mentioned in this report besides gold, are asbestos, californite, chromite, clay, coal, copper, lead, limestone and marble, platinum group metals, pumice, quicksilver, sandstone and miscellaneous stone. There are also numerous mineral springs.

#### ASBESTOS.

There are many large areas of serpentine, in which some prospects of asbestos occur and others may be expected, in this county. Most of these are too far from railroad for present consideration. Among the remote, unprospected areas may be mentioned the dikes and larger bodies of the rock which occur in the western part of the county, beginning six miles north of Orleans, thence recurring frequently along both sides of the Klamath River for many miles, and along the west side of the county to the Oregon line, as well as eastward along Salmon River from Somes Bar at intervals as far as Methodist Creek; near Hamburg Bar, north of Klamath River; near Scott Bar and in the Callahan district. Among the serpentine areas within reasonable distance of the railroad are the mountainous area adjacent to the county highway between Yreka and Fort Jones, and areas

near Yreka, near Montague in Shasta Valley, and near Gazelle and Dunsmuir.

Burns Ranch. Owner, W. L. Burns, Gazelle. Patented land in Sec. 16, T. 42 N., R. 6 W., four miles west of Gazelle.

A little shallow work has been done on a chrysotile asbestos prospect, showing fiber up to  $1\frac{1}{4}$  inches in length, but brittle. The quality might improve with depth.

- C. C. Cady Asbestos Prospect on Greenhorn Mountain, between Yreka and Fort Jones, was leased in 1923 to Geo. Souza who did some work. The surface showing of asbestos here can be traced for a considerable distance.
- Geo. W. Conrod, P. O. Box 577, Weed, sent in to the Bureau late in 1925, samples of slip-fiber (amphibole) asbestos. Locality not stated.
- *H. Johnson* of Sisson has seven locations for asbestos on Eddy Mountain, southwest of Weed and near the Trinity County line.
- J. J. Murray of Yreka several years ago located asbestos claims near the head of Seiad Creek, on a steep mountain four to five miles from the end of the wagon road, north of Seiad P. O. and nearly 70 miles from the railroad. Idle.

Shasta View Asbestos Prospect. Owner, W. S. Russell, Edgewood. In Sec. 8, T. 41 N., R. 5 W. Contains 12 unpatented claims, reached by three miles of good road from Edgewood. Elevation 4000 feet. There is plenty timber and water. Electric power is three miles distant.

Chrysotile asbestos occurs here and in 1921 a production of a small quantity of short fiber chrysotile was made. It was stated this carried 25% of fiber. Samples from the property show fully that percentage of fiber, one-half inch and less in length. There is some fiber one inch long.

National Cement Company of Modesto did some work in 1921–22 on the property, but it later reverted to Russell and is idle, except for assessment work. Development consists of short open cuts, not over 16 feet deep.

#### CHROMITE.

Considerable chromite was produced in this county during the war, and some of the remoter districts were just getting into production

when the armistice was signed.

At the height of the war minerals 'boom' in 1918 the State Mining Bureau published a book of 248 pages, designated as Bulletin 76, "Manganese and Chromium in California," in which were listed and described practically all the then known deposits of these minerals in the state, and this book is still available at fifty cents a copy. As there has been no market worth mentioning for chromite from this state since 1918, except small lots of high grade ore from properties nearby the railroad, there appeared to be no occasion for new field work in this connection. The main facts regarding chromite properties in the county are given in synopsis following.

#### MINERAL PRODUCTION OF

Year	Gold,	Silver,	Chro	omite	Mineral water		
I Cal	value	value	Tons	Value	Gallons	Value	
880	\$440,735	\$95,340					
881	850,000	1,500					
882	720,000						
883	720,000 400,000						
884	475,000						
885	338,659						
886	342,677 606,859	64 177					
888	625,000	111					
889	015 204	370					
890	860,303 957,220 1,013,332	23 120					
891	957,220	120					
892	1,013,332	56					
893	799,108						
894	760,782	177			200,000	\$80,800	
896	1 001 265	177 653			200,000	\$00,000	
897	950,006 1,091,265 842,123	34			3		
898	768 804	34 321			8		
899	991,771	100 26,700			8		
900	991,771 951,397 886,043	26,700			700,000 700,000	45,00	
901	886,043	22,980			700,000	175,00	
902	906,989	233			750,000	187,50	
903	013,070	1,230			750,000 750,000	50,00 50,00	
904	613,576 892,685 803,035	1,230 2,499			8	50,00	
906	8	3			3		
000							
907	398,017	3,037			725,000	36,25	
908	504,156	6,125			700,000	80,00	
909	416,160	2,145			500,000	10,00	
910	437,376	2,322			500,000	60,00	
911	422,297	2,561			700,000	120,00	
912	472,314	2,980	220	\$2,310	700,000	120,00	
1913	4180,125	41,228			700,000	120,00	
1914	312,842	1,026			650,000	65,00	
1915	426,716	0.004	1		626,680	62,99	
1916	441,307	2,081 2,312	2,251	28,731	502,650	50,53	
917	325,550	16,883	2,046	49,797	503,000	50,60	
	294,227	14,501	6,612	336,588	501,750	50,17	
918	454,446	14,001					
1919 1920 1921	226,525 80,707 42,635	17,049 5,218 294	510 215	13,379 5,732	451,500 300,150 250,150	90,37 60,01 5,01	
1922 1923 1924	75,105 45,633 63,570	612 298 296			200,150	4,04 6,10	
	\$4,967,925	\$193,567	311,854	\$436,537	*12,361,030	\$1,579,39	

Includes crushed rock, rubble, rip-rap, sand, gravel.

Recalculated to 'commercial,' from 'coining value' as originally published.

See under 'Unapportioned.'

Production from dredging operations included in Stanislaus County production.

Includes lead and mineral water.

Includes lead and lime.

Includes coal, limestone, lime and platinum.

#### SISKIYOU COUNTY, 1880-1924.

Platinum Group Metals		Miscel- aneous	Miscellaneous and unapportioned		
Ounces	Value	stone ¹ , value	Amount	Value	Substance
100	\$600				
••••					
••••					
•••••				\$1,202,742	Unapportioned, 1900-1909
			200.11		Common
•••••			200 lbs.	23	Copper.
1.6	21				
5.3	93		2,500 cu. ft.	1,250	Sandstone.
			2.500 cu. II.	1,500	Sandstone.
			193 lbs. 2,643 lbs.	39	Copper. Lead.
		\$39,000	2,045 108.	140 12,897	Sandstone.
		400,000	11,433 cu. ft. 1,000 bbls.	1,000	Lime
			220 tons	300	Limestone.
			4,949 lbs.	1,183	Lead. Sandstone.
••••			1,800 cu. ft.	1,485 1,680	Lime.
			1,090 lbs. 3,360 lbs.	144	Lead.
			50 tons	500	Pumice.
• • • • • • • • • • • • • • • • • • • •		5,028	1,050 cu. ft.	1,750	Sandstone.
			100 bbls. 2,225 tons	300 2,200 14,745	Lime. Limestone.
			2,220 tons	14.745	Gems.
			1,204 cu.ft.	2,000	Sandstone.
		9,475	335 bbls.	735	Lime.
			35 tons	525 1,000	Limestone. Gems.
			150 bbls.	120	Lime.
		6,580	24 tons	24	Limestone.
			650 cu. ft.	455	Sandstone.
		609	250 cu. ft.	250 250	Sandstone. Gems.
		000		250	Gems.
		4,883	} 90 tons	2,000	Pumice.
			100 4	1,500	Other minerals.
9	304	5,371	100 tons 58 lbs.	500	Coal. Lead.
	001	0,011	677 bbls.	629	Lime.
			250 cu. ft. 188 lbs.	150	Sandstone. Lead.
		4 000	188 lbs.	9	Lead.
		4,630	745 bbls.	745 16,923	Lime. Chromite, copper, marble, sandstone.
		45,407	(	12,609	Copper, building stone, lime, platinum, sandstone
			(	500	Granite.
15	709	134,382	888,043 lbs.	242,436	Copper.
			192 lbs.	17	Lead. Lime, sandstone, soda.
1	58	24,588	573,593 lbs.	8,535 141,677	Copper.
				15,473 111,294	Copper. Lead and pumice.
7	1,015	26,405		111,294	Copper, limestone, pumice, quicksilver.
***************************************		30,322		47,121	Copper, lime, limestone, potash, pumice, quicksilver Asbestos, brick, chromite, lime, platinum.
		44,343 21,726 129,291 67,787		1,060 4,020	Other minerals. ⁵
3	339	129,291		1,408	Other minerals.6
		67,787		3,034	Other minerals. ⁷
*141.9	\$3,139	\$559,827		\$1,861,129	
		1 4000,021		TI.001.149	

Attention should be called to the fact that since 1918 the Klamath River road has been made passable for trucks the entire distance from Hornbrook on the railroad to Somes Bar in the southwest corner of the county, where connection is made with the coast highways via Orleans. This opens up the large and only partly prospected areas of serpentine near the road, and is an outlet for the remoter areas west and northwest of the river to Del Norte County on the west and the Oregon state line on the north. This district was promising to be a big producer of chromite when the market failed, but the cost of hauling would be very heavy, as Happy Camp is 76 miles from Hornbrook.

The districts from which chromite production has been made in the county are: Callahan, Etna Mills, Fort Jones, Scott Bar, Yreka, Gazelle, Hamburg Bar, and Dunsmuir. In addition to these, and the others mentioned previously, there are other serpentine and peridotite

areas (listed under Asbestos) not so far productive.

The production of individual properties was in few cases over 500 tons, the largest producer being the Coggins deposit, three miles south of west from Dunsmuir, where the ore contained 38% to 40%  ${\rm Cr_2O_3}$ . The highest grade ore came from the Callahan district, where claims were 30 to 50 miles from Gazelle, the nearest shipping point. A large property near Hamburg Bar is about 48 miles from Hornbrook, and as it lies on the north side of Klamath River would require a bridge or tramway.

Besides the above localities, the following deposits have come to our attention since 1918, in addition to those listed in the tabulation of properties taken from our Bulletin 76:

H. Johnson of Sisson reports having a large tonnage of chromite six miles from the railroad, and within two miles of an old road.

Milne and Reichman Deposit. Owners, Geo. Milne and G. A. Reichman, Fort Jones. This is a large disseminated deposit of chromite  $1\frac{1}{4}$  miles from the Scott Bar road, 44 miles west of Yreka. The chromite occurs in seams and high grade ore must be sorted. The average is low grade. Six hundred tons have been mined, and most of it hauled to Yreka. Idle since 1919.

Mountain Chrome Mine. Owners, W. D. and N. Dale, address W. D. Dale, 2668 Fourth Avenue, Sacramento. This is seven miles southwest of Edgewood, in Sec. 24, T. 41 N., R. 6 W., near North Fork of Shasta River. The owners state that 100 tons of ore have been mined and that they have crosscut the ledge for 80 feet without striking the other wall.

Peg Leg Mine. Owners, W. P. Johnson, N. Lambert and Mrs. F. A. Shebley. Address N. Lambert, Fort Jones. This is 14 miles southwest of Yreka via road to Fort Jones, and near Moffit Creek. High grade chromite, containing 50% Cr₂O₃ was mined in 1918 and 1919. Ninety tons was shipped, an equal amount was on hand and the prospects were good for opening a larger body in the lower tunnel when visited by a Bureau representative in July, 1919.

#### Other properties mentioned in Bulletin 76 are tabulated below:

Manyo of number	$Section, township \\ and \ range$	Length of haul, railroad
Name of property		shipping point
Ball Ranch	16-41- 9	26 miles Yreka
Burns Ranch	16-42- 6	4 miles Gazelle
Butcher Ranch	Other furth their sales state state code	1 mile Yreka
Coggins		3 miles Dunsmuir
Chastain		
Cramer	22-44-8	14 miles Yreka
	[ 15-46-11 ]	
Hamburg Bar	{ 22-46-11 }	48 miles Hornbrook
	23-46-11	
Davis	10-39-9	38 miles Gazelle
Dexter Ranch	final title ware most days may made may	4 miles Montague
Facey		
Flederman	10-41- 9	28 miles Yreka
Flederman Lease	43- 8	15 miles Yreka
Grant Lease	25-42- 9	14 miles Yreka
~ ~ .	(13⊢40→ 8)	25 12 22 13
Grouse Creek	19-40-7	25 miles Gazelle
Le May	44-7	
Martin-McKeen	34-40- 9	36 miles Gazelle
Masterson	14-40- 8	Gazelle
McCarthy	11 10 - 0	- 32 and 42 miles Yreka
Musgrave	000 AND 1000 AND 1000 AND 1000 AND	92 and 12 miles frend
Souza Ranch		1 mile Yreka
Sugar Creek		40 miles Gazelle
The Chrome Mine	12-39- 9	36 miles Gazelle
Valine Ranch	12-59- 9	1½ miles Yreka
	dies han des des les les des	20 miles Yreka
Wilson Ranch		
Wurst	from their their their tipes trape your	35 miles Gazelle

At the time the chromite market collapsed, Siskiyou County was regarded as one of the largest prospective producers of the mineral in the United States, and it was estimated that the production in the next year would be 30,000 tons or more, mostly from the Klamath River deposits, located from Hamburg Bar westward.

#### COAL.

Lignite and sub-bituminous coal occur in Siskiyou County in Shasta Valley. Probably several thousand acres in this valley are underlain by coal.

Ager Coal Mine is on the Hagedorn Ranch, five miles south of Ager. Henry Hagedorn, owner. Years ago a slope 700 feet long on an incline of about 15° was sunk on the coal, which occurs between layers of hard shale, with alternating beds of hard sandstone above and below. The area has been mapped by Professor J. P. Smith as Tertiary. The normal dip of the strata is about 23° east, but in this vicinity the sedimentary beds have been broken by a series of basaltic intrusions, indicated by a line of low hills running in a southeasterly direction. The dip of the beds increases to 40° NE. near this line. From the incline three drifts were run north a maximum distance of 500

¹ Cal. State Min. Bur. Geologic Map of Cal., 1916.

feet, and three drifts south, the longest 400 feet, on the coal. A width of six feet carries coal, but the best, solid part of coal varies from 14 inches up to four feet, and is said to average two feet. The walls stood well without timbering. Five thousand tons or more have been produced and some of it sold. The last active work was in 1914–15 by Yreka Development Company, then lessee.

Numerous prospect holes have been drilled in the same vicinity on

the Hagedorn, Herr, Cooley and Denny Ranches.

On the *Cooley Ranch* a hole 130 feet deep is said to have struck 11 feet of coal at a depth of 118 feet. Another hole 106 feet deep is said to have struck 20 inches of coal at a depth of 95 feet.

Siskiyou Coal and Coke Company. R. D. Clark, President, Yreka. Leverett Davis, Mining Engineer. This company has leases on parts of ranches in Shasta Valley where coal has been found, as mentioned. In September, 1925, the company was putting down a diamond drill hole on the Herr Ranch, one-fourth mile north of the 106-foot hole mentioned above. The hole was down 110 feet and had not struck coal, which was not expected until a depth of over 200 feet. The core of the hole at time of visit showed alternating layers of sand-stone and shale. The sandstone was most abundant, and some of it is quite hard. The coal dips NE. 40° according to C. B. Kay, the steeper dip being on account of the proximity to the line of basalt intrusives. The company reports tests on the coal where previously opened indicating coking possibilities, but a classification as bituminous coal.

In the southeastern part of the county, in townships 39 and 40 north, ranges 1 west and 1 east, there occur outcrops of sedimentary rocks, forming the northern part of an area of Triassic and Tertiary sediments which extend north and east from near Redding. Just south of the Siskiyou County line in Shasta County some coal prospects have been noted in this area in Tertiary formations, but are not known

to extend into Siskiyou County.

There is a possibility of coal being found at the proper horizon anywhere in the Tertiary beds which are exposed from the Oregon line southward to five miles south of Ager, having a maximum width of eight or nine miles in townships 47 and 48 north, ranges 5 and 6 west, M. D. M. Such an occurrence is found on the James O. McMaster Ranch in the Hornbrook district, where nine feet of shale is intershot with small streaks and spots of soft coal, and there is also a seam up to two inches thick of what McMaster describes as "good hard coal, making a hot fire with a blue-green gaseous flame."

#### COPPER.

Very little progress has been made in the county in copper mining the past four years. After the price of copper fell, following the war, there was little incentive for the copper miners of Siskiyou County to produce ore, and since 1920 practically only necessary assessment work has been done. No new field work was done, therefore, among the copper mines and prospects for this report, and the following notes are a compilation of past reports, scattered among various pub-

lications in the past, but gathered here for readier reference; also a list of newer prospects.

Siskiyou County apparently contains some of the best unworked copper deposits in the state. The two most promising districts are near Happy Camp in the western part of the county, and near the northern county line on the headwaters of Applegate River. The two principal proved properties are the Grey Eagle near Happy Camp, and the Blue Ledge in the Elliott Creek district. There are numerous copper prospects throughout both the western and northern parts of the county, where gossan outcrops occur and have been slightly prospected, but not sufficiently to definitely indicate their possibilities. So far as known, only assessment work was being done in 1926.

The greatest hindrance to development of this branch of mining is the remoteness of the region from railroads. Happy Camp is 76 miles from railroad and most of the copper prospects are still farther away. From time to time there is talk of a railroad being built from the vicinity of Hornbrook down the Klamath River, and the possibility of this being done was last discussed in the summer of 1925, when John C. Sexton brought the subject of right of way before the county supervisors and according to press dispatches, stated a large tonnage of copper concentrate has been promised if the railroad were built. Due to the districts being in the national forest the federal government would not permit operation of a smelter.

Bulletin 50 of the California State Mining Bureau lists 45 prospects of copper in this county. This bulletin was published in 1908. Since that time, the Blue Ledge and Grey Eagle properties have been extensively developed and proved to contain considerable ore. Little has been done with the others. The principal production of copper occurred in 1917 and 1918, when about 1,460,000 pounds were sold. Developments in the past few years have served to emphasize the

widespread distribution of copper prospects.

Ames Prospect. Owner, A. Ames, Happy Camp. One claim on a gossan outcrop on the southwest slope of Clear Creek Canyon, eight miles by road and three miles by trail from Happy Camp. Only assessment work is being done.

Barton Claims. Owner, H. J. Barton, Yreka. Claims on Horse Creek, nine miles upstream from the mouth. Formerly known as the Hetchell prospect. Contains four claims. Idle.

Barnum Brothers Copper Prospect. (Copper Mountain Group.) Owners, Barnum Bros. et al. This group comprises 19 claims on Sambo Creek in Oak Bar district. It was equipped with a compressor and air drills in 1919 and in 1925 was under lease to Williams of Yreka, who was continuing an adit. Several hundred feet of underground work has been done.

Blue Ledge Mine. Owner, Mexican Smelting & Refining Co., 82 Beaver St., New York City. (Reported sold to Guggenheim interests in 1924, but is still assessed to above owner.) This property comprises 26 patented claims in T. 47 and 48 N., R. 11 W., in Elliott Creek district, at an elevation of about 5000 feet. Jacksonville, Oregon, is the nearest town and is 33 miles northeast.

The footwall of deposit is grey to black micaceous schist and the hanging wall is a white mica schist. The vein strikes nearly north, dips 60° west and averages 5 feet wide, though reaching a maximum width of 35 feet. A pay shoot 1500 feet long and 5 feet wide is reported proven by a series of adits and drifts which have developed the vein for a length of 1800 feet and a depth of 600 feet. In 1920 the management estimated that there were 240,000 tons of ore blocked out, having an average content of 4.8% copper, .035 oz. gold and 1.5 oz. silver. It is essentially chalcopyrite, and pyrite, the iron content going as high as 32%. The mine was operated up to the latter part of 1920 but has been idle since. Nearly 9000 tons of sorted ore was shipped. It contained an average of 13.7% copper, 5.5 oz. silver, .1 oz. gold, 30% iron and 30% sulphur. Steam was used for power, wood fuel from the claims being utilized. There is a compressor, air drills and underground hoist.

Bibl: Cal. State Min. Bur. Bull. 50, p. 123. R. XIV, p. 817; XVII, p. 530.

Buzzard Mine. See under gold quartz mines. The ore exposed in the mine workings immediately under the oxidized ore is a heavy sulphide, mostly pyrite, with a small amount of copper.

Clear Creek Mine. (Davis Mine.) Owners, Estate of Reeves Davis, et al. It is on Clear Creek, 13 miles southwest of Happy Camp. It has been quite extensively prospected, and gave an encouraging showing, but it is said that a good sized orebody could not be found in place. Idle.

Dillon Creek Prospects. In the summer of 1917, following a forest fire which cleared off the brush, eleven copper claims were located in the vicinity of the headwaters of Dillon Creek, which enters the Klamath from the northwest near Cottage Grove. Later the Grey Eagle Copper Co. did some prospecting in this vicinity, but the result of this is not known. The original locators of the claims were: Jettie Albars, Jack Davis, Swaney Peters, Wm. Elliott, Chas. and M. Thomas; Henry, Mrs. J. C. and Mrs. J. Aubrey, all residents of the Blue Nose and Somes Bar districts.

Efman & Boorse Prospect. Owners, Mike Efman and H. G. Boorse, Happy Camp. This is an undeveloped claim on a gossan outcrop in Elk Creek Canyon, two miles south of Happy Camp. Only assessment work was being done in 1925.

Grey Eagle Mine. Owner, Mason Valley Mines Co. of Nevada. It comprises 32 claims, mostly patented, in Sec. 4 et al., T. 17 N., R. 6 E., H. M., on mountain on the east side of Indian Creek, north of Happy Camp and 80 miles by road west of Hornbrook, the nearest railroad station. The elevation of main adit, No. 7, is 2539 feet.

The deposit is an ore zone trending southeast, varying in width from 10 to 80 feet, and carrying ore along fracture planes normal to the grey schist country rock. The ore is principally chalcopyrite, carrying an average of 6% copper. The sulphide ore is covered by a gossan cap. No. 7 adit has been run about 3000 feet southeasterly and

a total of about 10,000 feet of underground work is reported from this adit. Ore exposed on this level is said to be mostly pyrite, but where raises have been put up good ore has been exposed, as was also the case in the upper adits. Over 1,000,000 tons of ore are claimed to have been blocked out. The mine is equipped with a steam plant, large compressor, electric light plant, shops and buildings. Water is taken from nearby branches of Indian Creek. There were 60 men employed between 1916 and 1918, since when the mine has been idle.

Bibl: Cal. State Min. Bur. Bull. 50, p. 132. R. XIV, p. 818; XVII, pp. 531–532.

Henry Wood, Seiad P. O., has a copper prospect on Beat and Bender Gulch, near the Portuguese Mine, and has been doing some work the past summer.

Isabella Copper Mine. Owner, Isabella Copper Mining Co., 3228 Adeline St., Berkeley, Cal. This is a prospect containing 120 acres, in Sec. 34, T. 41 N., R. 7 W., 18 miles southwest of Gazelle. The vein is said to carry 'grey copper,' silver and gold. It has been developed by a shallow shaft and several adits. Equipment includes a steam plant, small air compressor and air drill.

Bibl: Cal. State Min. Bur. R. XVII, p. 532.

Liberty Bond Group. Owner, F. B. McCann, Happy Camp. This comprises 11 claims on a ledge in schist near a limestone contact. The ore is said to carry 1 to  $1\frac{1}{2}\%$  copper and several dollars gold per ton. Only assessment work has been done.

Bibl: Cal. State Min. Bur. P. R. 8, p. 14.

Malone Mine. Owners, Churchill, Roseburg et al. of Yreka. It is in Elk Creek Canyon, 14 miles by trail south of Happy Camp. Some good looking sulphide ore, carrying pyrite and chalcopyrite, has been exhibited from this property. The principal work is an adit 160 feet long.

Parker Group. Owner, Geo. J. Parker, Copper P. O. This comprises six unpatented claims in Sec. 20 or 21, T. 48 N., R. 11 W., in Elliott Creek district. About 200 feet of prospect adits have been run. The owner has been working alone.

Sunshine Group. Owner, W. J. Brown, Happy Camp. It contains two unpatented claims on a copper-bearing outcrop on Cave Mountain, five miles northeast of Happy Camp, three and one-half miles being by trail up the canyon of the creek. An adit has been run 130 feet at an elevation of 2040 feet, and it is expected the vein will be cut by raising 15 feet. Only assessment work is carried on.

## DIATOMACEOUS EARTH.

Ed Ewing, Yreka, has written the Bureau that he has 520 acres of land on which diatomaceous earth outcrops. This deposit has not been visited by a Bureau representative, so no particulars are available as to its location or quality.

## GOLD.

## Gold Mines (Lode).

Advance Mine. Owner, Victory Gold Mines Company. A. M. Buley, president. Office 1104 Pacific Mutual Building, Los Angeles. John Nefroney, manager. Comprises four patented claims, 73½ acres, in NW¼ Sec. 16, T. 40 N., R. 10 W., 23 miles by road and trail from Etna Mills at an elevation of 5000 feet.

This mine was discovered in 1902 and according to records kept by Woods, the former owner, has produced over \$250,000 most of which was taken out in 1906 and 1907, and principally in the form of 'high grade' or specimen ore. A five-stamp mill was operated on North Russian Creek and ore was hauled and trammed to it. The mine was sold to Victory Gold Mines Company in 1923 by Henry E. Woods.

Some of the old workings on the Advance show a quartz vein from two feet to four feet wide, which strikes N. 10° E. and dips to the west from 60° to nearly vertically. This vein carries calcite and in places shows free gold. These workings were 100 feet or less in depth, and some of the old crosscuts, drifts and stopes were open at intervals for several hundred feet along the north slope of the mountain. The recent work done by the company is on the south end of the Advance, and extending into the Hardscrabble claims. A boarding house, shop and portable gasoline driven air compressor have been placed here and drifting southward was in progress at time of visit, October 29, 1925.

The geological formations opened by work on this and adjoining claims comprise a series of belts of black schist, with schistosity striking north to N. 20° E. and dipping steeply west. This schist is everywhere penetrated by dikes, which strike usually parallel to the schistosity. They range from light to dark in color and in character from 'birdseye porphyry' and finer grained diorite to white rhyolite. The schist belts are at times 50 feet or more wide. In the schist, and running parallel to its schistosity, occur numerous stringers and small veins of quartz, some of which carry free gold. In the three adits started here, which were each 50 feet or less in length at time of visit, the schist belt is shown to carry a great deal of quartz throughout its width, the stronger veins having a width of nearly a foot, and lying on the footwall side of a 'birdseye' porphyry dike, near the footwall of the schist. Sacked ore shows free gold, and some samples of quartz broken from the formation in place panned well in gold. No proper system of sampling, assaying or mill tests has vet been adopted to determine the average value of this entire width of schist. The southernmost workings were stated to have crossed the south line of Advance property into the Hardscrabble.

The Mountain Lion vein lies 200 feet east of the Advance vein, strikes N. 10° to 20° E. and dips west nearly vertically. It is from two to five feet wide. The outcrop has been stripped for a short distance, showing a white dike on the immediate hanging wall.

Electric power could be brought from the Victory power line, a distance of three miles or less. Ten men were employed late in October, but it was expected the crew would be transferred to the Victory workings as soon as winter began.

Ames Prospect. Owner, A. Ames, Happy Camp. One claim adjoining Independence Mine, 14 miles by road south of Happy Camp. The owner has done only assessment work, and reports a prospect of 30 inches in width of quartz, panning well in gold, and believes the vein very similar to that in the Independence.

Builey Mine. In Sec. 35, T. 46 N., R. 9 W., seven miles NW. of Fort Jones, at an elevation of 5000 feet. Pocket mine. Idle.

Bibl: Cal. State Min. Bur. R. XIV, p. 826.

Baker Mine. In Sec. 15, T. 44 N., R. 9 W.,  $7\frac{1}{2}$  miles north of Fort Jones, at an elevation of 5000 feet. Pocket mine. Idle.

Bibl: Cal. State Min. Bur. R. XIV, p. 826.

Baldwin Group. Owner, J. C. King, Callahan. Contains 100 acres in W¹₂ of Sec. 18, T. 40 N., R. 7 W. in Callahan district, at an elevation of 3300 feet and 23 miles from Gazelle.

According to a field report by C. McK. Laizure ¹ an iron capped deposit containing quartz seams along a serpentine contact had been prospected by a shaft 60 feet deep, and the limonite and hematite showed some gold on panning.

Ball Mine. (See Ida May and California Consolidated.)

Ball & Goforth Prospect is in the Cecilville district. About 30 tons of ore were reported ready to mill in a small ball mill late in 1925.

Barnum Brothers Quartz Mine (formerly Robertson Mine). Owners, Al, Ira and Wiley Barnum, Oak Bar. On Horse Creek 6½ miles by road from Klamath River and 43 miles west of Hornbrook. A four-foot vein and rich stringer are being prospected. A Straub mill has been installed and in September, 1925, the owners were extending the road one-half mile up the creek from the Cook Placer Mine to their property.

Bender Mine. Forty acres in Sec. 18, T. 42 N., R. 11 W., four miles north of Etna Mills, at an elevation of 3300 feet. A short ore shoot in limestone and diorite is said to have yielded some specimen ore years ago, when it was worked through a 340-foot tunnel, with 250 feet of drifts on the yein.

Bibl: Cal. State Min. Bur. R. XIV, p. 826.

Big Ledge is six miles northeast of Greenview in the Oro Fino district and was formerly worked through an adit 360 feet long, producing some pockets.

Bibl: Cal. State Min. Bur. R. XIV, p. 826.

Black Bear Quartz Mine. Comprises 70 acres, patented, seven miles by road southwest of Sawyers Bar at an elevation of 4200 feet, near the west line of T. 39 N., R. 11 W. Owned by heirs of John Daggett, Black Bear P. O. This has been the most productive quartz mine in the county, with a past production of about \$3,100,000, but practically nothing has been done with it during the past 12 years. Original records of the operations under Daggett between 1870 and 1880 indi-

^{.1} Mining Engineer, State Mining Bureau, formerly in charge of Redding office.

cate a monthly bullion output of as high as \$75,000 with 16 light

stamps.

The mine was discovered in 1860, and for a year the ore was worked in an arrastra. In 1862 a 12-stamp mill was built and operations continued until 1865. The ore occurred in lenses, and it has been the history of the property that whenever one of these orebodies was worked out the operators became discouraged. At the above time, the property was sold to John Daggett, then Lieutenant Governor of California, and associates. They found another orebody and between 1866 and 1872, produced \$405,691 of which \$225,802 was paid in dividends. While still in ore, they sold to an English company, which between 1872 and 1886 produced \$1,933,745, and paid \$616,500 dividends. Ore becoming exhausted again, the owners sold out to Daggett, who resumed work and opened up the Yellow Jacket ground. Daggett from that time until his death only a few years ago retained ownership, except for a short period of operation by Rollin Mining Company.

The mine was worked through six adits and two shafts, one of the latter reaching a depth of 600 feet below the outcrop, where, it is said, there was a showing justifying work. On account of inadequate equipment and lack of funds the later operators, including F. A. Gowing, who had a lease on the mine in 1922, were unable to clear

these old workings and get into deeper ground.

The vein occurs in 'slate' striking north and dipping east 25° to 40°. At this late date, due to the death of Daggett and the absence of others acquainted with workings now inaccessible, it is impossible to give an idea of underground geologic conditions, but is believed that the property is similar geologically to the Klamath, Mountain Laurel and others on the same belt, except that the Black Bear ground has been less disturbed and broken. 'Porphyry' forms the footwall in places, and the ground is heavy.

The equipment is antiquated, although much of it could be utilized. Water is obtainable from Black Bear and Auges creeks through flumes each one mile long, and 1600 feet of pipe line. Electric power from a 100-h.p. plant two miles distant was used for the last operations. There is a compressor, tools and other equipment in great variety, and an old mill of 16 stamps weighing 650 pounds each. There are also a number of buildings. Eight stamps have been moved to the mine.

Bibl: Cal. State Min. Bur. R. VIII, pp. 620, 621; X, p. 656; XI, p. 431; XII, p. 277; XIII, p. 389; XIV, p. 826.

Black Hawk, Hidden Treasure and Triangle. Owners, W. L. McClaughry and Fred Martin, Yreka. Claims in Humbug district 16 miles west of Yreka at an elevation of 4400 feet. Two veins averaging about six inches wide have been prospected by adits 168 and 100 feet long. Said to have 500 tons of ore on hand at time of last report.

Black Hawk is in Sec. 31, T. 46 N., R. 7 W., five miles north of Gottville. Formerly a small pocket producer.

Bibl: Cal. State Min. Bur. R. XIV, p. 827.

Blind Lode Mine. Owner, Estate of H. J. Diggles. A patented claim, 17 acres, Lot 53 in Sec. 12, T. 43 N., R. 10 W., in the Oro Fino

district. Was worked in early days and said to have produced \$40,000 from a six-inch vein in diabase.

Bibl: Cal. State Min. Bur. R. XIV, p. 827.

Blue Jay comprises 160 acres, patented, in Sec. 11, T. 47 N., R. 8 W., five and one-half miles north of Gottville. Operated 20 years ago by Blue Jay Mining Company. There were two adits, 250 and 400 feet long, on a low grade vein up to five feet wide. There is an old 10-stamp mill.

Bibl: Cal. State Min. Bur. R. XIV, p. 827.

Bonanza Group. Owners, J. F. Wyrick and L. R. Pownell, Forks of Salmon. Three unpatented claims  $2\frac{1}{2}$  miles by road east of Forks of Salmon, the last mile being steep sled road. The claims are on the ridge between Crapo Creek and North Fork of Salmon River at an elevation of 3750 feet.

The owners report a vein averaging four feet in width striking east and dipping north. It was discovered in 1908 and has been developed by 19 tunnels and open cuts, from 25 feet to nearly 300 feet long. The ore is of good grade. The property has been worked exclusively by the owners for a number of years. Ore is crushed in a Gibson mill. Ore is delivered from the mine to mill by an aerial tram 1200 feet long.

Bonanza. In Sec. 14, T. 46 N., R. 7 W., 10 miles southwest of Hornbrook in the Cottonwood district. The locator produced \$10,000 from a pocket. Later a tunnel 1600 feet long was run. Formations are hornblende schist and diorite.

Bibl: Cal. State Min. Bur. R. XIV, p. 828.

Boss Mine. Owners, W. H. Wescott, Rollin P. O., et al. One claim on west side of Eddys Gulch in Sec. 16, T. 39 N., R. 11 W., three-fourths mile south of Rollin P. O. at an elevation of 3900 feet. This claim has been worked since 1888. It formerly belonged to the Dunphy Estate.

A vein from a few inches to two feet wide strikes N. 62° E. to N. 80° E. and dips 80° north, between a black slaty schist footwall and a hanging wall of similar rock, in which appear bunches and areas of decomposed acid dike rock locally called 'cab,' forming at times the immediate hanging wall. Several oblique faults of small throw have been encountered. The vein is usually tight, with hard walls and little or no gouge.

The lowest working is a crosscut 250 feet long, to the south, from which an inclined raise 97 feet long connects with a crosscut of 50 feet and a drift of 140 feet on the vein and fissure, which in places narrows, but is well marked even where devoid of quartz. This is new work, from which no ore has been milled. It is about 200 feet below the outcrop. Two old higher adit levels followed the vein for 100 feet and 140 feet, respectively, and in the upper of these workings a stope 100 feet long was worked on ore one foot wide, and said to have paid well.

Five men were employed late in 1925 laying track and preparing for erection of a small mill, as the owners believe this is justified by development in the lowest drift. Water sufficient for milling for six to eight months annually can be had from Evening Star Gulch, a small tributary of Eddys Gulch.

Boulder. Owner, J. M. Campbell, Dunsmuir. A prospect in Sec. 30, T. 29 N., R. 3 W., in the Soda Creek district. A vein said to average six feet in width has been prospected by the owner who has driven a main adit 350 feet long and several crosscuts, the total amount of work being nearly 2000 feet. The vein is free milling.

Boyle. In Sec. 8, T. 45 N., R. 8 W., 14 miles west of Yreka in Humbug district. Formerly operated through five adits, the longest 900 feet long, on two parallel veins striking northwest.

Bibl: Cal. State Min. Bur. R. XIV, p. 828.

Brown Bear. (See Cleaver Mine.)

Burton. R. H. Burton, Fort Jones. Claim and two 1000 pound stamps in Sec. 1, T. 44 N., R. 6 W. Idle most of the time in recent years.

Buzzard Hill Mine. Owners, Samuel J. Dunaway, Alvin Smith and Tony Kenney et al. Lessee with option to purchase, Buzzard Hill Mines, Inc. H. C. Cutting, president and general manager, Happy Camp, and 859 Monadnock Building, San Francisco. Comprises 12 unpatented claims,  $7\frac{1}{2}$  miles by road south of Happy Camp on Buzzard Creek, one mile south of Klamath River by private road, in Secs. 4 and 5, T. 15 N., R. 7 E. Elevation 1500 feet. The nearest railroad point is Hornbrook, 80 miles east.

The deposit is a vein of heavy pyrite ore, striking N. 14° E. and dipping 25° to 37° E. The width of vein varies from 2 feet to 12 feet as sampled, averaging over four feet. The ore has been almost completely oxidized to the outer part of No. 1 adit, about 90 feet on dip of vein, and above this working forms a soft, porous, light and easily workable mass, carrying finely divided free gold and quartz. The wall rock is dioritic or other basic schist.

No. 1 or lower adit runs north and east over 250 feet, showing heavy pyrite for most of this distance. The gossan ore shows little sign of copper to the unaided eye, but samples of massive sulphide taken in the east crosscut from No. 1 adit and tested in the State Min-

ing Bureau's laboratory showed one per cent to two per cent copper,

and this ore shows some chalcopyrite and a little malachite.

No. 2 adit, 54 feet on the dip above No. 1, cuts the vein 50 feet from the portal and is on oxidized ore for a distance stated to be 180 feet. At this point it is easy to observe that the work was turned east to follow a spur a short distance. There are two short intermediate levels between No. 1 and No. 2, and three raises from No. 1 to No. 2. The vicinity of the faces of different levels shows partly oxidized and partly sulphide ore, the level of sulphide ore rising as distance and elevation from the creek increases. The claims are only slightly prospected by the work done and if the sampling and assaying of the oxide orebody is truly representative, it should prove a profitable ore to work. According to estimates by M. J. Conover, there are 7900 tons of oxide ore available and proved, of an average value high enough to pay a good profit. So far the company has done little

toward milling the ore, and has not definitely decided upon the system to be used.

From the Buzzard workings to the Outlook workings, a distance of 2600 feet on the strike, no work has been done, but the vein has been slightly prospected at the Outlook. The work at the Buzzard group has been almost entirely for the purpose of prospecting the oxide ore. Such assays as are available for the sulphide ore show it to be low

grade in gold, silver and copper.

The camp buildings include new mess and bunkhouse, superintendent's house, assay office, garage, and machine shop and blacksmith shop. A small Hardinge mill, a rock breaker and Vandercook mercuric cyanide equipment have been delivered, but installation was suspended pending further tests of the amenability of the ore to this treatment. Power has not yet been provided, and can only be supplied economically by generating electricity locally. Buzzard Creek flows through the property, but is not large enough to furnish much power in the dry season. Some other creek, such as Elk Creek or Clear Creek, both within three miles, might be utilized. Properly constructed current wheels in the Klamath River could be used for generating power except at the height of the rainy season, when the river rises so suddenly and flows so swiftly that only the most rugged structures can stand against it. There is an ample stand of timber on the claims and near by on the national forest, and the company has a small saw mill.

Cape Cod comprises 40 acres, patented, and 75 acres unpatented, in Secs. 18 and 19, T. 45 N., R. 7 W., six miles west of Yreka. Reported production \$12,000 from 300 foot adit on two narrow parallel veins.

Bibl: Cal. State Min. Bur. R. XIV, p. 829.

Cassadoga Mine. Owner, J. L. Corbett, Hilt. Covers 3000 feet on strike of vein in Sec. 2, T. 47 N., R. 8 W., ten miles by road and trail west of Hilt on Bullion Mountain at an elevation of 5500 feet. According to a report by the owner, a vein striking east and averaging three feet wide lies between a granite footwall and mica schist and porphyry hanging wall. A tunnel cut the vein at a depth of 125 feet and it has been drifted on for 450 feet, with five raises of 50 feet each. Corbett claimed an ore reserve of 8000 tons of good grade in 1920, at which time the property was equipped with a 2-stamp steam mill, and was idle. Lately work has been resumed and during the past summer a 10-stamp mill was reported in course of erection.

Bibl: Cal. State Min. Bur. R. XVII, p. 533.

Central Mine. (See Union Mine.)

Central. An old property in Sec. 34, T. 48 N., R. 8 W., 16 miles northwest of Hornbrook in Hungry Creek district.

Bibl: Cal. State Min. Bur. R. XIV, p. 829.

Champion Mine. Owners, W. F. and J. A. Hunter, Orleans. Nine quartz claims in Sec. 33, T. 12 N., R. 6 E., H. M; eleven miles by trail from Orleans and 60 miles from Korbel, the nearest railroad point.

The owners worked the claims from the time of discovery in 1909 until 1917. Development consisted of two adit levels, which were 100 feet and 335 feet long at time of last report. The owners did all the work by hand. There is one 1000-lb. stamp and a two-ton cyanide plant. Water from Ten Eyck Creek is used for power. The vein is reported three feet or more wide, and bunchy, and owners claim considerable ore proven.

Bibl: Cal. State Min. Bur. R. XIV, p. 829; XVII, p. 533.

Chapman Prospect. Owners, J. and H. H. Chapman and T. L. Petersen. In Sec. 30, T. 7 N., R. 40 N., on Scott Mountain seven miles from Callahan and one-half mile from the Callahan-Carrville road. In 1922 a 5-stamp mill was built at the foot of the mountain four miles or more from the prospect and ore was hauled out through the snow in the spring at a great expense. About 40 tons milled are said to have yielded \$856. This came from a narrow seam in a shaft 80 feet deep, with a few feet of drift, where pay was lost. Previous work in an adit had produced about an equal amount. Idle.

Bibl: Cal. State Min. Bur. R. XX, p. 180.

Cherry Hill Mine. Owner, P. D. Thompson, Yreka. Comprises nine claims in Sec. 25, T. 45 N., R. 8 W., eight miles southwest of Yreka. This property has been worked for a long time in a small way. In later years the owner has been doing well working the property, and claims the ore will run about an ounce of gold per ton. On Cherry Hill, numerous veins and seams occur, some striking N. 60° to 70° E., and dipping 60° SW. Others strike N. 25° E. and dip 40° to 50° SE. These have been worked by a series of tunnels.

The claims are equipped with a small 4-stamp mill operated by a gas engine.

Cleaver Mine (formerly Brown Bear or Golden and Eveleth). Owner, I. K. Cleaver, Sawyers Bar. Contains seven unpatented quartz locations, of which the Eveleth, Brown Bear and Crystal have been most productive. In Sec. 14, T. 39 N., R. 11 W., on ridge at the head of west fork of Whites Gulch, elevation 4600 feet to 5000 feet. Sawyers Bar, the nearest town, is seven miles northwest and the mine is reached only by four miles of trail, leaving the road at the mouth of Whites Gulch.

The mine was first worked 35 years ago by Golden and Eveleth, who owned the claims several years and did most of the development. The Eveleth and Brown Bear claims are credited with a production of \$40,000 in all, and the Crystal, a fractional claim 300 feet long, with a production of \$35,000. A 4-stamp, water-power mill was operated about three months annually at that time, but at present is dismantled though still on the property. Most of the workings are now inaccessible because of caved ground. The lowest adit on Brown Bear claim, elevation 4640 feet (aneroid) was open for 200 feet at time of visit. This is 300 feet vertically below the summit of the ridge.

The principal vein strikes due east and dips 38° north. In the accessible portion of the lowest adit, the vein occupies the entire width, at least, of the adit, and a crosscut at the 200-foot point shows a width of 19 feet of solid quartz, stained by iron. In places it encloses

breceiated pieces of wall rock and is sugary in texture. On account of the width of vein and lack of crosscuts, little can be seen here of the walls, but near by the hanging wall is a breceia and footwall decomposed porphyry. Elsewhere, in the workings that are now inaccessible, the footwall is reported to be black slate and gouge, and hanging wall

porphyry.

Most of the work was on the Brown Bear claim. The longest and lowest adit runs west 900 feet from near middle of the claim. In the caved section an ore shoot 70 feet long and 16 feet wide is said by Cleaver to have averaged \$15 a ton. Outside of this shoot vein is reported to be two to six feet wide and low grade. The next adit is 80 feet higher and is a crosscut for 70 feet, then drifted on vein for 450 feet or more. The vein has a reported average width of six to eight feet, though widening to 38 feet in one place. A stope only 35 feet long was worked here, vein being low grade. The Blacksmith adit is 60 feet above the last named, and 300 feet long. The best ore was stoped out years ago above this adit.

The production of \$35,000 from Crystal claim is reported to have been from a 'big bunch' of quartz, from which the sulphides assayed well, but which paid \$8.10 per ton in free gold in the mill. This quartz body was entirely worked out, apparently. The last production

from the mine was in 1909.

A pipe line 700 feet long and flume of 900 feet would deliver enough water to furnish power for the mill for three months annually, and enough for battery purposes all the year. There are a few small buildings, but no equipment besides the 4-stamp mill and three-foot Pelton wheel.

Columbia Mine. Owner, Adrian J. Fisher. This contains 23 acres, patented, in Lot 2, Sec. 1, T. 45 N., R. 10 W. Base ore containing gold, copper and lead, occurs in a vein one to three feet wide. It was mined by crosscut and drift years ago, and ore was crushed in a 10-stamp water power mill on a five-acre patented millsite in Sec. 18, T. 45 N., R. 9 W., on Mill Creek. The Golden Eagle patented claim, containing 20 acres in Sec. 6, T. 45 N., R. 9 W., belongs to the same owner.

Commodore Mine is on Barkhouse Creek, three miles from the mouth, at 3490 feet elevation. A vein two feet wide has been worked by two tunnels and some ore crushed in an arrastra years ago. Two men are employed. H. J. Barton, owner, Yreka.

Bibl: Cal. State Min, Bur. R. XIII, p. 394.

Contact and Bonanza Claims. Owner, B. G. Reedie, Yreka. In Sec. 19, T. 46 N., R. 6 W., in Fools Paradise district 10 miles north of Yreka, at an elevation of 2100 feet.

The Bonanza vein strikes northwest, and Contact vein northeast and they vary in width from two inches to three feet. A depth of 90 feet has been reached and 230 feet driven on Bonanza vein and 60 feet in depth and 100 feet in length on the Contact. The Bonanza was stoped to a depth of 50 feet and for a length of 200 feet.

Corey Brothers Prospect. (Virginia Cons.) Owners, Corey Brothers, Callahan. Contains 80 acres in Sec. 29, T. 40 N., R. 7 W.,

eight miles from Callahan, seven miles being by road. A vein up to eight feet in width is giving some encouraging prospects to the three owners who have been working at the property only a short time. Address, George Corey, Callahan.

Corey Mine in Sec. 30, T. 40 N., R. 7 W., and Sec. 24, T. 40 N., R. 8 W., also belongs to Corey Brothers of Callahan.

Crawfish Gulch Mine. Owner, Sam Bratt, Oak Bar P. O. Forty acres reported to lie in Sec. 18, T. 45 N., R. 10 W., in Oak Bar district, 39 miles west of Hornbrook. Idle.

Bibl: Cal. State Min. Bur. R. XVII, p. 533.

Crawley Mine. In Sec. 22, T. 40 N., R. 8 W., near Callahan. Idle. Bibl: Cal. State Min. Bur. R. XIV, p. 830; XII, p. 396.

Cub Bear and Blue Jeans Prospects. Owner, Siskiyou Syndicate, I. J. Luce, president, 618 Second Avenue, Seattle, Washington. J. O. W. Applegren, Supt. Holdings stated to contain 640 acres, of which 240 acres are patented. Located 17½ miles from Etna Mills, the last 1½ miles being steep trail. In Sec. 9, T. 40 N., R. 10 W. Geologically similar to other properties in the district, carrying some small rich pockets, in the vicinity of which good milling ore occurs. Veins occur in hornblende schist and quartz porphyry and have been prospected by short adits and cuts. Only one man was employed in the winter of 1924–25 and the claims were idle in the summer of 1925. There is a two-stamp mill, erected in 1918.

Dewey Mine. Owner, Dewey Mines Company. Address F. A. Wright, 1744 Franklin Street, Oakland. In Sec. 6, T. 42 N., R. 6 W., twelve miles southwest of Gazelle. Contains 100 acres, patented. The elevation is 6800 feet. A vein striking N 40° E. and dipping 30° SE. has a width of three feet and occurs in granodiorite. Reported to have been a good producer previous to 1907, since when little work has been done. Development consists of a shaft 400 feet deep, a long adit and numerous drifts, raises and stopes. Ore was oxidized in upper levels but becoming base with depth. There is a mill of ten 850-lb. stamps, a Blake crusher, three Wilfley tables and old electric power equipment, all installed about 1898. The mill handled about 25 tons a day and made a recovery of about 75 %. The Dewey Mines Company operated only a short time.

Bibl: Cal. State Min. Bur. R. XIV, p. 831.

Double Eagle and Little Quartz Claims. In Sec. 26, T. 46 N., R. 9 W., near Barkhouse Creek. A pocket mine, in hornblende schist and granitic walls. The reported production was \$10,000. H. J. Barton, owner, Yreka.

Bibl: Cal. State Min. Bur. R. XIII, p. 397; XIV, p. 831.

Easter Mine. Owner, Frank Zollihofer, Yreka. One 20-acre claim in Humbug district. A vein four inches to twelve inches wide occurs in granite. The owner working alone ran several hundred feet of

drift and crosscut, and a shallow shaft. Water from Rider Gulch furnishes power for an arrastra.

Bibl: Cal. State Min. Bur. R. XVII, p. 533.

Eliza Mine. Owners, R. H. De Witt, Wm. B. Shearer, A. E. Lunker and O. H. Lawson of Yreka. Comprises five claims, 85 acres. in Secs. 4, 8, and 9, T. 45 N., R. 8 W., in Humbug district 15 miles by road northwest of Yreka.

A vein said to average five feet wide strikes north and dips 35° W. between quartz porphyry footwall and diabase hanging wall. The property was first located by D. M. Lash in 1865. It has been developed by five adits, the lowest of which was over 1700 feet long at last report, giving 360 feet of backs. It is claimed this lower adit is in ore averaging \$5 a ton in free gold for 1000 feet and that many thousands of tons of ore are blocked out. The past production is said to have been \$150,000.

There is an old 10-stamp mill on the property and plenty of timber. In late years work has been limited.

Bibl: Cal. State Min. Bur. R. XIV, p. 831; R. XIX, p. 138.

Enterprise Group. Owners, Geo. E. Townes and W. E. Tebbe, Weed. Comprises five claims, two miles northeast of Sawyers Bar, at an elevation of 3900 feet.

The vein is reported to be 30 inches wide and has been prospected to a depth of 150 feet, by an adit, winze and raise. Only assessment work is done.

Eureka and W. J. D. Prospects (formerly called Firebug). Owners, Dunphy Estate, Sawyers Bar, and W. J. Durch, Rollin P. O. On Blue Ridge, one mile north of Godfreys Ranch, a vein two feet wide has been developed by two crosscuts, and several hundred feet of work has been done. There is an arrastra on the property. Only assessment work is done at present.

Evening Star Mine (see Union Mine).

Fairchild Prospect is at the head of Long Gulch, west of Hawkinsville. Under lease and option to T. W. Billings and others in 1923, when a good prospect was reported.

Fagundez Mine (see Humpback Mine).

Falcon Prospect. On North Fork of Humbug Creek, at an elevation of 3400 feet and 11 miles northwest of Yreka. A vein nine inches wide in granodiorite, strikes northwest and dips vertically.

Bibl: Cal. State Min. Bur. R. XIII, p. 400.

Flag Prospect. In Humbug district, on Sucker Creek. A vein 30 inches wide occurs in granodiorite. It strikes north and dips steeply east. Was being developed in 1922 by J. L. Garrett et al. of Yreka.

Bibl: Cal. State Min. Bur. R. XIII, p. 401; XVIII, p. 297.

Fleetwood and Nannie S. Mine (formerly Jackson). In Humbug district, west of Humbug. Was worked by adits, seven of which were

driven, developing short ore shoots in porphyry, containing some rich ore.

Bibl: Cal. State Min. Bur. R. XI, p. 446; XIV, p. 832.

Franklin Mine. Comprises 40 acres on Indian Creek, in Sec. 16, T. 44 N., R. 9 W., in Deadwood district, 8 miles north of Fort Jones. A former producer, with a reputed output of \$90,000 previous to 1913. The ore is said to have run about \$25 a ton. The mine was worked through an adit with drifts and stopes on the vein.

Bibl: Cal. State Min. Bur. R. XIV, p. 832.

Franks and Moncton (see Osceola Mine).

Galena Mine. In Humbug district, on divide between Sucker Creek and Middle Fork of Humbug, 12 miles northwest of Yreka. A small producer years ago.

Bibl: Cal. State Min. Bur. R. XIII, p. 401.

Gilfeather Group. Owners, J. B. Nowdesha and J. J. White, Hamburg Bar. This group comprises 3 quartz claims on Collins Creek, which enters the Klamath from the south at a point  $2\frac{1}{2}$  miles west of Oak Bar. The claims are on the side of the canyon 2 miles upstream from the mouth of the creek and one-third mile from the creek.

On one claim, 4 adits ranging in length from 40 to 60 feet have been run, and one of the others has been prospected by open cuts. In the uppermost adit the vein shows two stringers 5 inches wide separated by 8 inches of gouge, and in a lower adit vein is 8 inches wide.

Gilta Quartz Mine (formerly Gold Hill). Comprises 60 acres, patented, in Sec. 12, T. 9 N., R. 7 E., on ridge between the forks of Knownothing Creek, eight miles by trail south of Forks of Salmon. Owner, G. A. Dannenbrink et al., Etna.

This was one of the best producers of the district, having an ore shoot three feet wide in slate and diorite walls. It is equipped with an old 10-stamp mill which has been operated by steam or water power. In the past 10 years it has been worked only in a sma!! way by lessees. The last operations ended July 4, 1925, when Wahlheim and Burkig, who had been leasing the property and making some production, ceased work.

Bibl: Cal. State Min. Bur. XIV, p. 833; XI, p. 429; XIII, p. 407 (Hungry Hill).

Golden Eagle Mine (formerly Indian Creek Mine). Owner, Geo. Milne, Fort Jones. Contains 37 acres, patented, Min. Surv. 4590 in Sec. 11, T. 44 N., R. 9 W., in Deadwood district, 10 miles north of Fort Jones. This property was worked by the Indian Creek Mining Company many years ago. It was opened by shaft and drifts which finally reached a length of 750 feet on vein, giving a depth of 240 feet below the outcrop. The ore was stoped out above this level.

Four parallel veins, striking north, one dipping west and the others east, are claimed to exist. Ore shoots were 200 feet long, and 15 to 36 inches wide, between diabase and quartz porphyry walls. Ore from

west dipping vein was said to run \$14 a ton, and total past production is claimed to have been about \$500,000.

Milne began work in the spring of 1924. There is a six-stamp mill, steam hoist, Giant air compressor and electric power on property.

Bibl: Cal. State Min. Bur. R. VIII, p. 625; R. XIV, p. 832; Field Report, C. McK. Laizure.

Golden Eagle Claim. Owner, Adrian J. Fisher. Contains 20 acres, patented, in Sec. 6, T. 45 N., R. 9 W.

Golden Seal Claim. A pocket mine in Oro Fino district, Sec. 18, T. 43 N., R. 9 W., five miles northeast of Greenview.

Bibl: Cal. State Min. Bur. R. XIV, p. 832.

Golden West Prospect. On Trail Creek, in Sec. 15, T. 39 N., R. 10 W., 13 miles west of Callahan at an elevation of 7000 feet. A well defined fissure vein in schist, reported to be four feet wide and assaying well.

Bibl: Cal. State Min. Bur. R. XIV, p. 832.

Golden and Eveleth Mine (see Cleaver Mine).

Gold Hill Mine (see Gilta Mine).

Gold Run Mine. A former producer, but idle for many years. Ten miles by trail south of Forks of Salmon, between the forks of Knownothing Creek.

The Gold Run vein averaged 20 inches wide and had an ore shoot which was 20 feet long on the surface, but increased to a length of 110 feet on the upper adit level, 450 feet deep on the dip of vein. South of this, the ore stopped, but a wider orebody was found by crosscutting through the footwall. The Hunter vein averaged 12 inches wide, with an ore shoot from 80 feet to 150 feet long.

The property was equipped prior to 1891 with a 4-stamp mill and small cyanide plant. The working cost was high, but the ore was good grade, carrying gold coarse enough for the most part to amalgamate in the battery.

The geology of this property was covered in the Eleventh Report of the State Mineralogist, pages 429–431, which see. No recent work has been reported.

Goodman Prospect. Owner, Joe Goodman, Happy Camp. This is a quartz prospect on Indian Creek near Classic Hill Mine, north of Happy Camp. Only assessment work is done.

Grizzly Gulch Mine. A pocket mine in Sec. 14, T. 44 N., R. 9 W., in Deadwood district, 10 miles north of Fort Jones, at 7000 feet elevation.

Bibl: Cal. State Min. Bur. R. XIV, p. 833.

Gumboot Prospect is in Sec. 15, T. 45 N., R. 9 W., eight miles east of Scott Bar. Shallow workings showed base ore, carrying some copper.

Bibl: Cal. State Min. Bur. R. XIII, p. 404; R. XIV, p. 833.

Hansen Mine. On North Fork of Knownothing Creek, eight and one-half miles by trail southwest of Forks of Salmon. Contains

60 acres, patented. Owners, Roberts and Hagland.

Narrow veins were worked here between 1880 and 1900. The pay shoots were short, but ore rich, most of the gold being saved by battery amalgamation. The geology of this district is covered in detail in the Eleventh Report of the State Mineralogist, pages 429–431, which see.

In May, 1924, the property was reported under lease and option to a company of Los Angeles people represented by James Farraher, but no activity was reported during 1925.

Hardserabble Prospect. Comprises five unpatented claims in Sec. 16, T. 40 N., R. 10 W., 22 miles by road from Etna Mills, between Advance and Victory mines. Owners, reported to be A. M. Buley and E. J. Miley, Sr., of Los Angeles, and John Nefroney of Etna Mills. Elevation 5000 to 5400 feet.

Numerous short crosscuts, drifts and raises have been run in the course of many years of prospecting and assessment work, the property having been worked by different prospectors and by Hardscrabble Mining Company in previous years, but without any available record

of production. There is no equipment on claims.

Geological conditions revealed by the workings visited are similar to those in the Advance (which see), which adjoins on the north, and Victory, on the south. The most extensive prospecting has been on the Tom Tit claim, which lies along the saddle of the ridge. An adit 372 feet long runs north to N. 20° E. in black schist and the accompanying dikes. This is connected by raise 101 feet long with upper drifts. As the work is all near the crest of the ridge, the north faces are approaching the surface on the north side. These workings show a quartz vein from six inches to four feet wide, carrying calcite, striking north to N. 20° E. and dipping 72° SE. At frequent intervals the vein jumps from one side to the other of the accompanying dike.

The only work at present on the claims is that being done on the north end from the Advance portals.

Hazel Mine (also called Jillson Mine). Contains 80 acres, patented, in Sec. 25, T. 47 N., R. 8 W., in Cottonwood district, four miles southwest of Hornbrook. Owner, Hazel Gold Mining Company, Chico.

Address I. O. Jillson, 609 Masonic Ave., San Francisco.

This has been the principal quartz gold producer of the district, being credited with a total output of \$800,000. It was discovered in 1883 and the present mill was built in 1899. The Hazel Gold Mining Company operated about three years after the mill was built. In later work the ore averaged \$30 a ton, but was hard to follow, due to faulting. There are three veins, two of them parallel, in slate. An ore shoot 150 feet long and three feet wide was worked. Development was by a series of five adits, the longest 1500 feet, and several thousand feet of development in all was done.

The equipment includes dwellings, assay office, mill of ten 850-lb. stamps, driven by water and steam power. Water is supplied from

Ditch Creek through one mile of ditch.

The property was leased in 1925 to F. A. Gowing of Berkeley and some activity was promised in the autumn.

Bibl: Cal. State Min. Bur. R. XIV, p. 833.

Hegler Mine (see Oregon Mine).

Hickey Mine. Ed Hickey, owner, Sawyers Bar. Five claims in Whites Gulch, about 3½ miles by trail from the mouth of gulch, and at an elevation of 4660 feet (main workings). The last productive work on this property was by lessees 12 years ago and the workings are mostly inaccessible. It is reported to have two parallel veins, two inches to 18 inches wide, about 300 feet apart, and striking east. It was worked by adits, the longest 400 feet or less in length, but as no one was found at the property no exact details were available. The man who milled some of the ore reported it occurred in bunches sometimes worth \$200 a ton. Reported production \$35,000. There is an old 5-stamp mill, in poor condition, on the gulch over a mile from the workings and ore was hauled to it. This mill was run by water power.

Hicks Mine. An old property in Sec. 2, T. 46 N., R. 7 W., seven miles northwest of Hornbrook. A very narrow vein occurs in granodiorite and was worked by an adit. The ore was crushed in an arrastra.

Bibl: Cal. State Min. Bur. R. XIV, p. 834.

Highland (Old Highland). Owners, Foster Brothers. Comprises 60 acres on Trail Creek in Sec. 12, T. 39 N., R. 10 W., 12½ miles southwest of Callahan. Reported leased with option to T. M. Taylor, C. Wilson, J. R. Porter et al., in 1922. There is a 2-stamp water power mill on the property.

Bibl: Cal. State Min. Bur. R. XIV, p. 834.

Highland Prospect. In Sec. 25, T. 46 N., R. 7 W., in Cottonwood district, three miles west of Hornbrook. An ore shoot 125 feet long and 10 feet wide was worked through an adit 1500 feet long. Has been idle recently.

Bibl: Cal. State Min. Bur. R. XIV, p. 834.

Highland Mine. Assessed to A. Nininger. Herman and J. II. Mattern and J. T. Collins are also part owners. Operated for many years under direction of Herman Mattern and Sons of Ashland, Oregon. Property comprises 320 acres, being S½ of Sec. 9, T. 40 N., R. 10 W. It is 20 miles from Etna Mills and 50 miles from Gazelle or Yreka, the last 3½ miles being steep trail, as the mine is at an elevation of from 5500 to over 6000 feet.

The property was not visited by the writer, and the following notes

are from various reports believed reliable.

The mine was discovered in 1899 by P. Mussic, who is reported to have produced \$147,000 of gold from specimen ore by hand mortaring. He was sued by a relative who had advanced him \$30 as a grubstake, and who finally got the entire mine, a half-interest going to the lawyers as their fee. These people erected a 2-stamp mill and produced a large sum. One lot of 1800 pounds of ore is said to have paid \$29,000; another

of 1100 pounds yielded \$42,000. They operated in the summer seasons only for nine years and in 1909 sold the property for \$80,000 to Belgium-Bohemian Mining Company, a European company. Between 1909 and 1914, this company is supposed to have produced \$280,000 according to Herman Mattern. They took out all easily accessible ore, but were hampered by the war, and did little work after 1914. In 1919, creditors bought the property at sheriff's sale, since when there has been irregular work. Five or six men have been employed during the summer of 1925.

The main vein strikes N. 40° E. and dips SE. and varies from one to six feet wide. The enclosing formations are schist and granodiorite, traversed by dikes, varying from acidic to basic in character. The veins traverse both schist and granodiorite. Two other veins are reported, but unprospected. The main or Highland vein has been worked to a vertical depth of 184 feet, and for a length of 700 feet. Two stopes 60 by 4 by 70 feet have been worked, and high grade ore has been underhand stoped, there being a winze 60 feet deep. The vein contains white 'sugar' quartz, some bluish quartz and calcite. The present mode of operating is expensive on account of the number of times rock must be handled.

Equipment includes a triple discharge 2-stamp mill, with a capacity of five tons per day, which is operated part of the year by a Pelton waterwheel and part time by a 15-h.p. gasoline engine; a 40-h.p. gasoline engine, a 3-drill air compressor, blacksmith shop, bunk house, cook house and office building.

Hoboken Mine. Owner, Estate of H. J. Diggles. Forty acres, patented, in Sec. 21, T. 45 N., R. 8 W., in Deadwood district, a mile and one-half by trail from Cherry Creek road and 11 miles north of Fort Jones. Elevation 4500 feet.

The vein, said to vary from six inches to six feet thick, was worked through three crosscut adits, with drifts on the vein. No. 1 (upper) adit was drifted on vein for a reported length of 500 feet, and ore stoped out above it and worked for the free gold in an arrastra many years ago. The next level, 290 feet below No. 1, opened quite a heavy flow of water on striking the vein, and a third adit was started to drain this. In depth the ore shows 2% to 5% of sulphides.

In 1919, R. N. Diggles reopened the mine and extended the upper adit 100 feet, and also worked in the lower adit. A Gibson mill was installed. In 1922, the property was leased and late that year good

prospects from the lower adit were reported.

Bibl: Cal. State Min. Bur. R. XII, p. 284; XIII, p. 406; XIV, p. 835; XVIII, p. 496.

Homestake Mine. Owner, R. S. Taylor, Yreka. Under lease and option to purchase by Homestake Consolidated Mines, Inc. President, A. T. Maning, 2113 Third avenue, Seattle. Secretary, J. B. Macdonald, 923 Birks Building, Vancouver. J. A. Maguire, superintendent.

The property is in the southern part of T. 41 N., R. 10 W., on west side of North Russian Creek, 16 miles by road southwest of Etna, at an

elevation of 4200 to 4800 feet.

Formations are quartz porphyry, dioritic schist and muscovite schist, similar in general to the formations at the Highland mine. The property has been a small producer of specimen rock since 1902, and some milling has been done, the vein material close to the 'high grade' being of good

mill grade. The 'high grade' occurs in a greyish, fine-grained muscovite schist. The ore being milled at time of visit was black schist ore, carrying a reported content of \$20 a ton, mostly free gold, with one or two per cent of auriferous pyrite and galena. A few thousand dollars production was made during 1925.

The present company began work in November, 1924, and in October, 1925, had 10 men employed, most of them outside preparing for winter. The mill of two 1200-lb. stamps has been operated since August, 1925. Water for power and other uses comes from Taylor Creek through 800 feet of ditch and 260 feet of six-inch pipe. There is a two-drill compressor. Besides the mill there is an assay office, boarding house and several buildings. The *Hogan* property, adjoining, is also under lease to this company.

Humpback (Fagundez) Quartz Mine. Owner, Rollin L. Fagundez, Merced. Contains 80 acres, patented, in Secs. 4, 5, 8, 9, T. 39 N., R. 11 W., on ridge between two forks of Eddys Gulch three miles by road and trail from Sawyers Bar. Claims are Azores No. 1 and No. 2, Humpback Quartz Mine, two placer claims and two millsites.

During the early nineties this property was equipped with a five-stamp mill and was one of the best producers of the district. The vein is said to have ranged from three inches to twelve inches wide, and a man mined only about one-half ton a shift, but the ore was rich and pockety, yielding \$30 to \$200 a ton in the mill. It is locally credited with a gross output of \$260,000. Idle for many years.

Bibl: Cal. State Min. Bur. R. VIII, p. 619; XI, p. 432; XII, p. 281; XIII, p. 386; XIV, p. 835.

Ida May Quartz Mine. Owner, A. J. Ball, Rollin P. O. Comprises Ida May, Frances Bell and Lucky Strike quartz claims, 54.2 acres at Rollin, four miles by road south of Sawyers Bar and at an elevation of

3700 feet, on ridge between two forks of Eddy Gulch.

The vein occurs in the black crushed slaty schist of the district, and strikes southwest, with a flat dip averaging about 22° northwest. On the footwall side the black graphitic schist has been ground to a putty-like gouge from two feet to fourteen feet thick, carrying considerable broken quartz. This gouge swells on account of its limestone content, requiring good timbering and close lagging in places. The slaty schist formation common to practically all the mines of this immediate district appears as a flat blanket deposit which has been ground to gouge along its contact by local movements. The vein is said by the owner to average four feet wide in the pay shoots, but the workings in ore are mostly inaccessible on account of caving, and the present work was not yet in permanent vein matter, although quartz was coming in.

The vein has been prospected and ore developed by a series of adit levels only a short distance apart vertically, but giving considerable backs because of the flat dip of vein. No. 1 level was 252 feet long and No. 2 was 160 feet long, and Ball states that from these levels and their stopes he has produced 2000 tons of ore yielding \$45,000. This was oxidized ore, and sulphide ore was not struck until a depth of 400 feet on the dip was reached, within 60 feet of the face of No. 3 level. This latter level was run 321 feet northwest then southwest 230 feet on the vein from the Ida May into the Frances Ball claim. Crosscuts on each side from this drift were run diagonally across vein for 60 feet. Off No.

3 adit 160 feet in, a drift runs 120 feet a few degrees south of east, to a raise 40 feet high into vein, which was followed up on dip 160 feet above No. 3 adit. Ball states this level has produced \$25,000. On account of the crushed condition of the ground, nearly all underground work is by hand picking, very little explosive being used.

No. 4 level is 28 feet vertically, or 90 feet on dip, below No. 3 and was 384 feet long, with the heavy footwall gouge showing in face at time of visit in September, 1925. A raise and intermediate level above No.

4 was showing broken quartz.

There is a two-stamp mill on the property which is operated in season by water power and four men are employed. The old Klamath mill, containing 19 stamps, adjoins.

Independence Mine. Owner, Buzzard Hill Mine, Incorporated, a Delaware corporation, with an office at Mt. Kisco, N. Y. H. C. Cutting, president and general manager, Happy Camp. The Independence holdings comprise seven quartz locations, covering 4500 feet along the strike, on Independence Creek in Sec. 32, T. 15 N., R. 7 E., 4000 feet southeast of Klamath River and 14 miles by road south of Happy Camp. Elevation 1225 feet. Hornbrook, the nearest railroad station, is 87 miles east.

Rich ore was first found on this property about 1895 by Joe Biggs, who extracted \$6,000 and sold out. The property changed hands several times, each succeeding owner believing he had the best part of the gold in the property before he sold it. Stock & Kleaver are reported to have produced \$10,000 and Jack and Claude Zachary and Wm. Kleaver, the last owners before the present company, are credited with having taken out \$60,000. II. C. Cutting claims that his company had produced over \$100.000 up to August, 1925. The early work was mostly in a shallow shaft known as the 'grubstake hole,' on the apex of vein a short distance above the present adits.

The vein strikes N. 42° W. and dips 56° to 70° SW. in the lower workings but at the discovery point dips northeast. The ore so far developed has been found in a lens of quartz 150 feet long, varying from one foot to five feet wide, and averaging three feet wide. The country rock is ancient basic schist, gabbro and diorite, classified as pre-Cambrian by J. P. Smith. Serpentine forms the immediate walls of the vein, and a horse of the same rock fills a large part of the fissure. On the hanging wall side of the vein numerous vugs of all sizes occur, where part of the rock has been leached out leaving quartz and soft seam filling. But although the hanging wall side of vein showed several good bunches of specimen ore at the time of visit, it was said the footwall had yielded most of the gold.

The vein has been proved on the strike for 700 feet. Besides the Discovery or Grubstake shaft, two adits, the upper 180 feet long and the lower 230 feet long, had been run prior to time of visit in July, 1925, giving a depth of about 100 feet on the vein, and a winze which was full of water was said to be 50 feet deep below the lower adit. High grade ore, some of it well filled with gold, was followed down from the shaft and was picked up in the adits and followed up in raises. It is 52 feet on the vein from No. 2 to No. 1 adit. In the upper five feet of a raise run here to pick up the downward extension of

¹ J. P. Smith, Geologic Map of California, Cal. State Min. Bur., 1916,

specimen ore found in a 14 foot winze from the upper adit, it is said \$43,000 in 'high grade' was removed. Below here in this raise, called East Raise No. 1, an unknown but probably smaller amount of such ore remained. Forty feet distant in West Raise No. 1 high grade ore also showed for 15 feet or more above the adit. Such ore is also reported in the bottom of the Grubstake shaft above No. 1 level, and in the winze 50 feet below No. 2 level, these being about midway horizontally between the raises.

A private road 4000 feet long from the camp at the river to the mine workings was being built in July, 1925. Water is obtained from Independence Creek, which runs nearby and parallel to the vein. A new flume 6000 feet long to have a capacity of 500 cubic feet a minute and a head of 220 feet at the mine, was planned. The company also planned to bring a ball mill of 50 tons capacity from the Buzzard Mine, and install a water wheel, air compressor, drill sharpener and other equipment. Fifteen to twenty men were employed. There is plenty of timber near the mine.

A quantity of rich specimen ore, estimated to have contained over \$25,000 in gold, was taken from the mine in August, 1924, and caused a sensation when shown in the State Mining Bureau's exhibit at the convention of the American Mining Congress at Sacramento that year.

Tests on ore from the lower adit have indicated the possibility of profitably milling the quartz outside the specimen ore shoots,

Inyo Mine. Comprises 20 acres in Sec. 2, T. 45 N., R. 8 W., in Humbug district 11 miles west of Yreka. An old pocket mine, with a production of \$4,000 previous to 1913.

Bibl: Cal State Min. Bur. R. XIV, p. 835.

Ironsides Mine. In Sec. 26, T. 45 N., R. 8 W., seven miles southwest of Yreka. A pocket mine.

Bibl: Cal. State Min. Bur. R. XII, p. 285; XIII, p. 408; XIV, p. 835.

Johnson and China Paul Mine. A pocket mine in Sec. 12, T. 43 N., R. 10 W., in Quartz Valley district.

Bibl: Cal. State Min. Bur. R. VIII, p. 826; XIV, p. 835.

Jumbo Mine (Ruby Basin). Owners, Geo. E. Towns and W. E. Tebbe, Weed. Five claims in Sec. 1, T. 39 N., R. 11 W., in Whites Gulch,  $1\frac{1}{2}$  miles above the mouth by trail and  $4\frac{1}{2}$  miles from Sawyers Bar.

It was a small producer 20 to 25 years ago, an ore shoot reported 160 feet long and three feet wide having been milled. It was sold by Cullberg to the present owners about 1914. They spent \$12,000 but crushed no ore, and mine has been idle in late years. It is said that the ore slimed excessively, and recovery was only about 20% by amalgamation. The mill contains 10 light stamps formerly operated by water power, but has been idle for 20 years or more and is in poor shape.

Bibl: Cal. State Min. Bur. R. XIV, p. 840.

Kangaroo Mine. A pocket mine, in Sec. 29, T. 40 N., R. 7 W., nine miles southeast of Callahan.

Bibl: Cal. State Min. Bur. R. XIV, p. 836.

Katie May Mine. In Greenhorn district, Sec. 24, T. 45 N., R. 8 W., and contains 20 acres. Was worked by an adit and 80-foot shaft, and ore was stoped four feet wide, 60 feet long and 50 feet high. It was sufficiently high grade to haul many miles to a custom mill.

Bibl: Cal. State Min. Bur. R. XIII, p. 409; XIV, p. 836.

Keynote Group. Owners, C. E. Weston, Yreka, Charles G. Peterson, 1825 Oak Street, San Francisco, and Charles Magill, c/o Land Depart-

ment, Southern Pacific Co., San Francisco.

This comprises six unpatented claims in Sec. 30, T. 34 N., R. 6 W., Fools Paradise district, six miles north of Yreka near Shasta River. Gold bearing quartz was discovered by Horace Howe in 1922 and the claims were leased to W. E. Anderson. Soon afterwards 75 tons of ore was mined and hauled to Yreka where it was crushed in a custom mill and according to a report by Magill, yielded \$22.50 a ton in free gold. This ore came from a length of 40 feet and depth of 40 feet on the vein. The vein has been developed for a length of 600 feet by a series of short adits and open cuts. The maximum depth prospected is 175 feet below the apex on the hillside. The workings so far have been in the surface oxidized zone, and show an igneous dike on one wall. No work is being done at present.

King Solomon Mine. Owner, Edgar H. Cottrell, Westerly, R. I. Mineral Survey 4532 in Secs. 13 and 14, T. 38 N., R. 12 W., at head of Mathews Creek, three miles due northwest of Cecilville at an elevation of 3500 feet. This property was a good producer previous to 1914 but has been idle lately. A shallow orebody was mined and milled in an eight-stamp mill.

Bibl: Cal. State Min. Bur. R. XIV, p. 836.

Kinkaid Prospect. Owner, John Kinkaid, Sawyers Bar. One unpatented quartz location on Jackass Gulch, five miles by trail from the mouth of the gulch and seven miles north of Sawyers Bar. This is equipped with a small Ellis Chili mill. Kinkaid also has two unpatented quartz locations four miles by steep trail from Sawyers Bar at the head of Jessops Gulch. So far only surface prospecting has been done on a disseminated deposit at the latter place and there is no equipment. In years past some gold pockets containing pieces worth as much as \$50 each have been mined in a small serpentine area at the head of Jessops Gulch.

Klamath Group. Owner, A. J. Ball, Rollin P. O. Contains four quartz locations named Mabel, Protection, Arctic and Zero, being relocations of Ada, Flora Blanch, Ohio and Buckeye claims, respectively, of the old Klamath Mine, a former producer, situated on ridge at the head of Eddys Gulch, elevation 4240 to 4800 feet, and 1½ miles southwest of Rollin P. O. by road.

The main vein on this group and that on the adjoining Central and Mountain Laurel mines on the north no doubt are on the same fissure,

although between the Klamath and Central there has been a narrowing of the fissure where no ore has been found for some distance, as shown in the Central workings.

The black slaty schist or 'slate' as it is called locally, is the most important formation in the district, carrying practically all the payable veins. The Klamath vein strikes between north and northeast and dips from 5° to 45° southeast, at an angle to the schistosity of the enclosing schist. In both walls close to the vein, occur bunches and lenses of light colored porphyritic intrusive rock, usually entirely altered in place, and locally called 'cab.' The strongest veins in this district have pronounced post-mineral gouges, as noted in the Central, Ida May, and other workings. There are said to be two or three overlapping strata of quartz separated by horses, in some of the old Klamath workings. The width of vein and of ore varies from two feet to 24 feet, and in places selective mining has been done, leaving bodies of good looking but probably low-grade quartz.

The Ada and Flora Blanch claims were first operated in 1863-65 by the Union Mining Company which had an eight-stamp mill and is said to have produced \$59,400. Between 1870 and 1881 the Klamath Mining Company mined and milled 33,680 tons, which yielded \$418.549 and speimens worth \$25,000. In 1883, \$30,000 was produced. These figures were largely substantiated by C. W. Raymond who made

numerous assays and measurements of old stopes in 1906.

Later records are less exact, as this mine and the Mountain Laurel were subsequently operated jointly by several companies, and ores from both were milled in the same 20-stamp mill at Rollin. The old mill handled only about 20 tons in 24 hours. The Gold Ball Consolidated Mining Company between 1887–95, the Yreka Mining and Milling Company about 1900–06, and the California Consolidated Mining Company up to 1910, all operated the two groups but worked principally in the Mountain Laurel. Yreka M. & M. Co. mined and milled 23,300 tons which yielded \$184,000 from the two groups in five years up to 1906, according to Raymond.

There remains in the Klamath Mine according to A. J. Ball, considerable low grade ore. The stoped width of ore varied from two feet to six feet as a rule, and value per ton ranged from \$5 to \$12 but must have averaged nearer \$12 a ton if production figures are correct. The average tailing loss was estimated at one dollar in free gold and eighty cents per ton on account of not saving concentrate. The mine was worked by a great number of adits, and stopes varied in length from 50 to 400 feet on the strike. In later years a tramway was built from the mine to the mill, but all equipment is at present in a

state of decay.

Lanky Bob Mine. Owner, Denny Bar Company, Etna. On East Fork of Whites Gulch, five miles by road and trail from Sawyers Bar. This was formerly a producer, but has been idle for several years. Its output was possibly \$50,000. Under lease and option in 1925 to Thomas Salisbury. There is an old mill on the claims.

Little Bonsa Mine. Owner, C. W. Gordon, Yreka. Thirty acres in Sec. 9, T. 45 N., R. 7 W., four miles northwest of Yreka, at an elevation of 3600 feet. This is a pocket mine, with one vein striking east

and another northeast. Production to 1920 was about \$8,000, which was taken out by the owner, working alone.

Livingstone and Everton Pocket Mine. Owner, T. E. Ahlstrom, Ashland, Oregon. In Happy Camp district.

Lucky Strike Mine (see Osgood Mine).

Malloy Quartz Mine (Oregonian Group). Owner, Dan Malloy, Sawyers Bar. Includes Snowbird, Gold Bug and other claims on the south side of Tanners Peak, at head of Rattlesnake Gulch at an elevation of 5000 feet and  $3\frac{1}{2}$  miles by road and trail from Sawyers Bar.

A vein six inches and upward in width occurs in granite, and has been prospected and mined in a small way, with considerable production of gold, for the past 40 years. Malloy works alone most of the time, and makes an occasional crushing of ore in the 3-stamp mill, which is operated by a gasoline engine. The mine is opened by adits.

Bibl: Cal. State Min. Bur. R. XII, p. 289; XIII, p. 419; XIV, p. 838.

McClaughry Group. In Sec. 8, T. 45 N., R. 8 W., in Humbug district. Bibl: Cal. State Min. Bur. R. XIV, p. 837.

McKeen Mine (see Oro Grande).

McKenzie Mine. Owner, W. H. Herndon, Gottville. It is on Lum Grey Creek,  $5\frac{1}{2}$  miles by road and trail from Gottville. There is a 2-stamp mill on the property. It was active in the summer of 1925.

Mosher & Lowell are working a quartz claim on Horse Creek one-fourth mile from Barnum Bros. They have been developing the claim for two years and have a 10-stamp Straub mill.

Wm. Might has a group of claims on Indian Creek near Classic Hill Mine, where he has been prospecting for several years. He has no equipment except hand tools.

Monarch Quartz Mine. Owner, L. W. Godfrey, Sawyers Bar. This comprises four claims on Methodist Creek, seven miles above the mouth.

A quartz vein, stated to be up to 10 feet in width but of pockety character, has been developed by a series of short adit levels, raises and stopes, the longest adits being 200 and 300 feet in length. There is a 2-stamp mill on the property which is operated by water power and the total production of the property is said to have been about \$12,000.

Morrison and Carlock Mine (formerly Little Queen). Owner, Reichman Mercantile Company, Fort Jones. It is in Quartz Valley district, four miles northwest of Greenview, at an elevation of 2800 feet, and

contains 60 acres of patented land.

This was the best quartz producer of the district but has been idle since 1907. It is credited with a production of about \$500,000. Previous to 1900 the ore was worked in an arrastra but later a 10-stamp mill was built and the mine was developed by a shaft to a vertical depth of 400 feet, with eight levels, the longest drift reported 1200 feet southwesterly. There was also an old adit 1500 feet long.

The mine was under lease and option in 1925 and was being unwatered in the autumn. L. C. Monahan, superintendent. The equipment

includes an old steam hoist, 10-stamp mill, electric power, dwellings and assay office.

Bibl: Cal. State Min. Bur. R. XIII, p. 413; XIV, p. 837.

Mountain Laurel Quartz Mine lies at the head of the left fork of Eddys Gulch, five miles by road south of Sawyers Bar at an elevation of 3600 to 4000 feet. It was one of the producing quartz mines of the district for many years, but has been idle since the last work was done by F. A. Gowing in 1922.

The vein, which strikes north to N. 40° E. and dips 5° to 60° SE., occurs in the black, slaty graphitic schists which carry most of the gold ores of this district. It has been prospected and exploited by a series of six adit levels. The principal production in later years was by the Yreka Mining and Milling Company up to 1906, and by the California Consolidated between 1906 and 1910.

The May adit at 3810 feet elevation was run 535 feet southeast, then drifted 130 feet southwest and 280 feet northeast, but was not productive of ore. The Mi adit, 60 feet above and 280 feet east of May adit, cut the ledge 200 feet from the portal and followed it 140 feet northeast and 250 feet southwest. Ore of good grade, from three feet to six feet wide, was stoped on the southwest nearly to the surface. Mj adit, elevation 3870 feet, is 520 feet southeast of the north end of Mountain Laurel claim and 400 feet east of the west side line. It cut the vein 270 feet from the portal, and a small chamber of high grade ore found near here is said to have yielded 60 tons of ore worth \$7,000. In all about 2300 tons was stoped from this level. About 590 feet from the portal a winze was sunk 180 feet to Stevens tunnel level, and levels called 90, 100 and 150 levels were run northeast under the Wisconsin Claim. On the 100 level, 8800 tons of ore averaging 51 feet in width and \$18.40 per ton is reported to have been mined. The ledge generally has a flat dip and the 100 level was only 42 feet vertically below the adit. The Stevens tunnel was a long lower level from which a great deal of work was done. Due to the long time since this mine was discovered, the various companies concerned, the loss of records, and the fact that the mine was worked at times in conjunction with the nearby Klamath, using the same mill, it is impossible to accurately determine its output, but it probably produced over \$600,000 from ore averaging \$8.50 or better a ton. The California Consolidated Mining Company is said to have produced \$90,000 between 1906 and 1910.

The Mountain Laurel unpatented ground has been relocated, in part by A. J. Ball of Rollin, who holds four claims, formerly known as the Liberty, Wisconsin, Illinois and Golden Eagle, and in part by William Wike of Sawyers Bar. Only assessment work has been done the past few years. There is an old 20-stamp mill, fitted for operation by water

power, on patented ground at Rollin.

Mountain Lily Quartz Mine. Owner, G. A. Conzetti, of Cecilville. Property comprises seven claims, a six-stamp mill and arrastra. The principal vein has been traced 6000 feet and prospected to a depth of 150 feet. Idle.

Bibl: Cal. State Min. Bur. R. XVII, p. 534.

Mount Vernon Consolidated Mine. Owners, James S. Dobyns and Cora N. Jacobs, Yreka. Comprises four patented claims and one unpatented claim, 75 acres in all, in Sec. 26, T. 45 N., R. 8 E., eight miles west of Yreka by good road, at an elevation of 4434 feet.

These claims have been worked irregularly for over 50 years. They cover 3000 feet on the strike of two veins, and have been prospected by adits which give a maximum depth of about 600 feet below the outcrop. On 100, 200 and 300 levels, the vein has been drifted from 400 to 500 feet, and has been stoped out above 300 level. The lowest level has been run 800 feet with a raise of 100 feet. The veins strike north and northwest and ore shoots are said to have varied from 30 to 60 feet in length and had a width of about 14 inches.

The mine has been worked by several companies and the total output is unknown. The equipment consists of 5-stamp mill, built in 1904, operated by electricity, using 20-h.p. motor; Blake crusher, with 15-h.p. motor; air compressor and drills, with 20-h.p. motor, and ore car, blower and tools. There is plenty of timber, and water sufficient for milling.

The ore is said to run from \$4 to \$25 a ton with some high grade, and concentrates carry from \$40 to \$80 a ton. The last work was in 1918–19 by Mt. Vernon Gold Mining Company.

Mountain King Group. Owner, D. C. Weaver, Orleans. Three claims in Prospect Hill district, 12 miles north of Orleans, at 4000 feet elevation. This is a prospect located in 1918.

Neilon and Putnam Prospect. Miles Neilon and W. Putnam, owners, Sawyers Bar. On Counts Gulch (a tributary of Whites Gulch)  $1\frac{1}{2}$  miles from the mouth and  $4\frac{1}{2}$  miles from Sawyers Bar. A prospect discovered in 1921. Contains two claims on which only superficial work has been done. Said to show a vein up to four feet wide, prospecting well. A few tons of ore have been crushed in a small Chili mill.

The claims were leased with option in 1925 to Thomas Salisbury.

New York Mine. Owner, J. B. Scott, Brownsville, Texas. M. C. Beem, agent, Fort Jones. Mineral Survey 4134 in Sec. 2, T. 44 N., R. 9 W., nine miles north of Fort Jones at an elevation of 3300 feet. Contains 77 acres, patented.

Parallel veins and seams of quartz strike N. 20° E. and dip nearly vertically, with numerous faults, cross veins and stringers. The mine was first worked on the surface in 1856, when pockets were mined. Formations are diorite and porphyry. Average width of pay ore is said to have been two feet, and values were spotted in the lower levels.

A depth of about 800 feet on an incline of 45° is said to have been reached. The monthly production at one time was from \$6,000 to \$10,000, according to J. A. Hight. Equipment includes a steam hoist, air compressor, boilers, 10-stamp mill and two concentrators, and electric motors.

Nigger Boy Mine. In Sec. 2, T. 46 N., R. 7 W., five miles southwest of Hornbrook. It was developed prior to 1914 by two adits, 1000 feet and 80 feet long, and an ore shoot was claimed to have been opened. In 1921, A. D. McCullough had an option on three-fourths interest in the property and was driving a new crosscut adit. Equipment includes dwelling, tools, shop and 2-stamp mill. Water is obtained through a ditch a mile and one-half long from Ash Creek.

North Star Mine (Boyle Mine). In Sec. 8, T. 45 N., R. 8 W., in Humbug district 14 miles from Yreka. This was one of the principal producers of Humbug district, where the ledges were generally small and worked only to water level, for the most part. This mine was equipped with a 4-stamp mill and a Huntington mill over 35 years ago and at that time employed 20 men. It was developed by a series of adits to a shallow depth and yielded ore running \$20 to \$100 a ton.

The operations were described in detail in the Eleventh Report of State Mineralogist, pages 444–445, which see. Some repair work was

done in 1921-22 on the mill and buildings.

Ohio Mine. In Sec. 8, T. 46 N., R. 6 W., Fools Paradise district. Sixty acres, patented.

Bibl: Cal. State Min. Bur. R. XIV, p. 838.

Old Vet and Eclipse. In Secs. 10 and 11, T. 45 N., R. 8 W., in Humbug district.

Bibl: Cal. State Min. Bur. R. XIII, p. 418, XIV, p. 838.

One Hundred Dollar Prospect. Owners, Sam Wallace, Frank Smith and Wm. Perkins of Sawyers Bar. This is a recent discovery on the top of Tanners Peak, five miles by road and trail north of Sawyers Bar, and at an elevation of 6500 feet. A vein six inches wide is reported to give flattering prospects but no development has been done yet, although the claim has changed hands several times.

Oregon Mine (Hegler and Aldrich Mine). Ed Mathewson, owner. On Lawson Gulch, in Sec. 3, T. 45 N., R. 8 W., in Humbug district, at

an elevation of 3800 feet.

This property was worked, beginning 35 years ago, by three adits 80 feet apart, the lowest a crosscut 180 feet long, with 720 feet of drifting on the vein. The ore was milled in a 5-stamp mill, using steam power. The vein strikes northeast and dips steeply east. It was said the vein averaged \$5 a ton in free gold and was two to six feet wide. A new crosscut adit was started in 1923 to search for the vein below the old workings. It was expected this would have to be 900 feet long.

Bibl: Cal. State Min. Bur. R. XI, p. 446; XIII, p. 405.

Oregonian Group (see Malloy Mine).

Oriental Quartz Mine. Owner, John Joseph, Sawyers Bar. At the head of left fork of Eddys Gulch, one-half mile from Rollin, and adjoining the Boss Mine. This claim has been worked for many years in a desultory way, and made some production years ago. The present work is in an adit which is being run N. 55° W. at an elevation of 3900 feet, and had reached a length of 112 feet at the end of September, 1925. A vein two to three feet wide with a very heavy gouge on the hanging wall was cut near the face. It lies nearly flat and both walls are black, slaty graphitic schist. The heavy gouge was probably caused by hillside drag along the plane of the vein. One man employed.

Oro Grande Mine (McKeen or Shasta Mine). Owner, Oro Grande Mg. Co. J. R. McKinnie, president. Office, 637 Citizens National Bank Building, Los Angeles. H. McKinnie, secretary. Contains 473 acres

patented, and 200 acres, unpatented, in Sec. 36, T. 40 N., R. 9 W., in Callahan district. Gazelle, the nearest railroad station is 31 miles northeast. Elevation is 4000 feet.

Five veins occur in granodiorite. They strike northeast and the principal one dips 85°. It varies from 18 inches to four feet wide, averaging two feet. Development consists of five adits, giving a vertical depth of 400 feet below the outcrop, a maximum length of 3000 feet on the vein and a total footage of 8000 feet of tunnels and 300 feet of raise.

The production previous to present company is reported to have been \$500,000 for about one-half of which there is a definite record, but none for the product of arrastras and former 3-stamp mill. The present company ran the mill only for experimental purposes but have done nothing since 1916. Most of their work was done underground, and J. R. McKinnie claims about 50,000 tons of ore proved, which ranges in value from \$5 a ton on the lowest level to over \$11 a ton on the next level 193 feet higher, where the vein was sampled for 400 feet. The average value is thought to be \$7 or \$8 a ton.

The mine equipment includes shop, compressor building, warehouse, sawmill, bunkhouse and boarding house for 50 men, a 4-drill compressor

and air drills.

The milling plant contains Blake crusher, 100-ton ball mill, Senn amalgamator, K. & K. flotation machine, tanks and zinc boxes.

A good water right is owned on Boulder Creek and there is ample good timber.

Oro Grande Mine. Owner (at last report), Trask and Corinson. In Secs. 10 and 11, T. 45 N., R. 7 W., in Humbug District. Contains 100 acres, with four parallel veins having dolomite footwall and porphyry hanging wall. It produced \$20,000 previous to 1914, ore having been worked by a shaft 160 feet deep and adit 300 feet long with a stope 80 by 4 by 40 feet.

Bibl: Cal. State Min. Bur. R. XIII, p. 419; XIV, p. 838.

Osceola Prospect. James Keaton, owner, Sawyers Bar. Three quartz locations on mountain between Whites Gulch and Counts Gulch, five miles by road and trail from Sawyers Bar and between Uncle Sam and

Hickey Mines.

This prospect once belonged to Sheffield, formerly owner of the Uncle Sam Mine, but he abandoned it. A millman who milled two lots of ore totalling 150 tons from the claims states it averaged \$6 a ton. Keaton bought the claims from J. Johnson. This property was not visited by the writer, but is stated to show a large low grade dike of porphyry and quartz, panning gold. It strikes southwest and dips southeast. It has been prospected by two adits, 125 feet and 150 feet long, one drifted on the vein 60 feet. A third and lowest adit 340 feet long has not yet reached the vein according to Keaton.

Osgood Mine. Lessees, Judson C. Hubbart et al. Situated two miles west of Yreka. Elevation 2800 feet. Holdings consist of eleven claims.

Several different vein systems occur in a belt of metamorphic slate, porphyry and schist, striking north and south, with the general trend of the range, and dipping almost vertically. The belt is interrupted and broken in many places due to local disturbances. The auriferous

veins follow the strike of the belt, and are usually of narrow widths. Four of these vein systems have been cut by a crosscut tunnel 116 feet in length, the pay streaks occurring in narrow seams and fractures in the zones. Oftentimes the quartz is entirely lacking in the veins, the gold being deposited along fractures in the rock. About 90 per cent of the values occur as free gold, little pyrite being found. The limits of the ore zone are well defined and are determined by panning. Most of the work is confined to the 150-foot shaft, from which it is reported over \$10,000 was taken. The shaft is intersected by a tunnel at a depth of 150 feet. Considerable stoping has been done from the 100-foot level to the surface, where the vein was evidently of good width, while little work has been done below that level.

Equipment consists of blacksmith shop, assay office, 5-stamp mill, with 1050-lb. stamps, and amalgamation plates. Mill is driven by 30-

horsepower motor.

The property was leased with option to J. C. Hubbart et al. in 1916 and sampling and mill tests were carried on by Hubbart until 1921, work being done on the *Spring Gulch*, *Wacker* and other claims as well as on the Osgood. All of these claims and others, have been consolidated by Hubbart under the title of Empire Mining and Milling Company, of which Hubbart is superintendent. This company has offices at Yakima, Washington. They have not been working on the claims.

Bibl: Cal. State Min. Bur. R. XIX, p. 138.

Outlook Mine. Owner, Outlook Mining Company, Happy Camp. Four unpatented claims in Sec. 4, T. 15 N., R. 7 E., H. M., seven miles by

road south of Happy Camp, on south side of Klamath River.

These claims are reported to be on the northward extension of the Buzzard Hill vein. A small amount of work has been done one-half mile north of the Buzzard Hill workings. This work consists of an open cut across the vein, two short adits and an incline 30 feet deep, the total amounting to 100 linear feet. The vein is said to be the same in character as at the Buzzard, with same dip and strike, and similar values. The depth of oxidation is shallower, and copper has been noticed in the sulphide.

Overton Mine. In Sec. 16, T. 40 N., R. 10 W. Owner (1913), Over-

ton Gold Mining Company.

A small producer up to 1914. The ore was packed on mules two miles to the Advance mill on Russian Creek. Idle.

Bibl: Cal. State Min. Bur. R. XIV, p. 838.

Pilot Knob Mine. Owner, Pilot Knob Mining Company (lapsed as a corporation). Secretary, T. K. Anderson, Gottville, is a principal owner. Contains 15 quartz locations on Empire Creek, three miles by road from Gottville and 20 miles from Hornbrook. Title uncertain for some claims.

This is a large, low grade deposit, gold occurring in stringers of quartz and in the schist. It was first found in 1882 and some work was carried on up to the time of the war, since when the property has been idle until 1920 on account of high costs. In 1920, considerable prospecting was done. A vertical depth of 200 feet below the outcrop was reached in an adit 500 feet long, but other short adits have prospected the

surface 600 feet below the apex of hill. Various mill tests over a width of 400 feet are reported to show up to \$4 a ton, but probably in general the rock is lower grade than that.

Equipment consists of 5-stamp mill fitted to operate by water power or gasoline engine, being belted at present to a tractor engine. Empire Creek passes the mill but carries little water in summer. There are several buildings on the property.

Pilot Knob & Kearsarge Claims (Midwinter & Modoc). Owner, R. G. Reeder, Yreka. Two claims in Sec. 30, T. 46 N., R. 6 W., ten miles north of Yreka.

Two veins strike north and east, respectively, and vary from a few inches to three feet wide. Midwinter vein has been worked through four short adits and two shallow shafts and Modoc vein through two adits.

A few thousand dollars production is claimed.

Bibl: Cal. State Min. Bur. R. XVII, p. 535.

Porphyry Dike. Owners, Mr. and Mrs. Charles Slater, Callahan. One claim in Sec. 18, T. 40 N., R. 7 W., in the East Fork district, 23 miles from Gazelle.

This claim was equipped in 1921 with a small ball mill. The dike carries some gold and occurs along the serpentine contact. Elsewhere in this district, dikes of which the upper parts have been oxidized and softened by weathering, have been worked by hydraulicking.

Prospect Hill. In Sec. 30, T. 12 N., R. 6 E., 11 miles north of Orleans. There is a 3-stamp mill on the property, which has been worked by adits and has made some production.

Providence Mine. In Sec. 18, T. 43 N., R. 9 W., in Oro Fino district five miles northeast of Greenview. Formerly worked as a pocket mine.

Bibl: Cal. State Min. Bur. R. XIII, p. 421; XIV, p. 839.

Quartz Hill Mine (see under Gold Placer Mines).

Rainbow Mine. Owners, T. C. Quin and Newton Gordon, Hawkinsville. A good prospect of free gold was reported in a crosscut 90 feet long, 50 feet below the surface. Some work was done in 1922–23.

Bibl: Cal. State Min. Bur. R. XVIII, p. 733; XIX, pp. 58, 93.

Red Hill Mine. In Sec. 4, T. 45 N., R. 7 W., five miles north of Yreka. It was formerly a small producer, ore from a narrow vein having been hauled to Yreka for milling.

Bibl: Cal. State Min. Bur. R. XIV, p. 839.

Reeder Group. In Sec. 8, T. 46 N., R. 7 W., in Fools Paradise district 6½ miles southwest of Hornbrook. Reeder produced considerable gold from pockets, working alone. The total output previous to 1914 was estimated at \$50,000.

Bibl: Cal. State Min. Bur. R. XIV, p. 840.

Robinson Gulch Prospect. In Sec. 18, T. 40 N., R. 10 W. A pocket mine, not recently active.

Bibl: Cal. State Min. Bur. R. XIV, p. 840.

Ronning Quartz Prospect. Owner, Southern Pacific Company. Lessee with option, P. R. Kelsey et al. In Sec. 19, T. 40 N., R. 7 W., five miles east of Callahan and 21 miles from Gazelle. In October, 1925, a crosscut had reached a length of 100 feet and it was expected would have to be run 90 feet farther before cutting a vein which prospected well on the surface. A Huntington mill, a 5-stamp mill from the Chapman prospect and a rod mill have been taken to the property.

Schroeder Mine. It is in Secs. 17 and 18, T. 45 N., R. 8 W., 7 miles west of Yreka. It was extensively developed by adits 30 years ago and ore was milled in a 10-stamp steam power mill. It contains 5 patented claims, most of the work having been done on the Rosalie vein. Some prospecting work was being done in 1925, with a small crew.

Bibl: Cal. State Min. Bur. R. XIII, pp. 424, 425.

Scioc Mine. Owners, S. F. Bentley et al., Fort Jones. It is Min. Surv. 4016 in Sec. 13, T. 43 N., R. 10 W. in Quartz Valley district. A vein 1 to 2 feet wide has been prospected by a shaft 68 feet deep with 68 feet of drifting. There is a 2-stamp mill (1250-lb. stamps), a rock breaker, two gasoline engines, ore cars, tank and pipe. Water is scarce and ore has to be hauled 200 yards to mill. Reported to show good ore in face. One man employed in 1925.

Siskiyou Gold Mines Co., R. M. Snyder, president and Mrs. Anna Davis, secretary, 2045 East 70th street, Chicago, Ill. The holdings comprise 4 claims, three of which were bought from E. W. Morgan. They are on Horse Creek 8 miles above the mouth. The development work consists of a crosscut reported to be 335 feet long, 12 feet of drifting on one vein and 40 feet on another. Equipment consists of a 10-stamp Straub mill, a tractor, two old trucks and a pump to raise water from the creek.

Slim Jim Quartz Mine. Owner, G. G. Skillen, Sawyers Bar. One claim on west fork of Whites Gulch, two miles by trail upstream from the mouth, and five miles east of Sawyers Bar. A vein varying in width from two inches to two feet, averaging one foot, and striking nearly north between quartzite and schist walls, was worked through a tunnel 200 feet long and a raise to surface giving 80 feet of backs. Ore to the amount of about 100 tons was reported by the owner to have averaged \$20 a ton. It was worked in an arrastra with a capacity of one ton in 24 hours, which was operated by a water wheel 23 feet in diameter. Cost of mining and milling was \$5 a ton or more. No ore has been crushed for several years.

Snowflake (formerly Bear Den) and Little Gem Quartz Claims. Owner, James Cavanaugh, Rollin P. O. The claims are on Eddys Gulch adjoining the Boss Mine,  $4\frac{1}{2}$  miles from Sawyers Bar. The Snowflake claim has been worked in succession by Stent, Behnke and Cavanaugh, and has produced \$8,000 or more, the last work by the latter having yielded a few tons of ore paying \$23 a ton in free gold in an arrastra. The vein ranges up to  $2\frac{1}{2}$  feet wide and strikes north. The Little Gem is a fractional claim 400 feet long on which little work has been done,

Uncle Sam Consolidated Quartz Mine. Owner, Sheffield Estate, address Ed. Sheffield, Greenview. Sixty acres, patented, on divide between headwaters of Counts Guleh and Whites Gulch, elevation 5000 feet, and seven miles by road and trail from Sawyers Bar. This was one of the older quartz mines, located in 1873 and for many years a

satisfactory producer, though idle in recent years.

The mine was opened by a series of crosscut adits from 120 feet to 550 feet long, with drifts on the vein for a maximum length of 420 feet. The vein strikes N. 20° E. and dips 45° to 60° SE., and is reported to have averaged  $3\frac{1}{2}$  feet in width between 'porphyry' hanging wall and 'slate' footwall. Early reports state the ore yielded \$18 to \$20 a ton in free gold down to the 500-foot level (364 feet deep), where the percentage of sulphides was three per cent to five per cent. Ore was crushed in an 8-stamp mill, operated by water power only during a short season in spring, due to small supply of water at this elevation.

Union Mine (formerly Central or Evening Star). Owner, Rollin Mining Company. Address Ben Daggett, or Leslie Daggett, Black Bear. Comprises two quartz locations one mile south of Rollin and between Klamath and Mountain Laurel Mines, at an elevation of 3900 feet. Lease and option to purchase held by Albert Ford, 10 Clifton avenue, San Jose, and C. H. Walters, 465 Marshall street, San Jose.

This mine was a producer years ago, having a record of \$79,000 production from 7000 tons of ore. The surface of claims is a steep slope facing north near the head of Eddys Gulch, and the claims are separated on the north from the Mountain Laurel and on the south from the Klamath Mine by gullies which probably mark the courses of faults. It seems nearly certain that all three mines are on segments of

the same fissure, or closely parallel fissures.

The outcrop of the Central vein, striking nearly north, was worked for a length of 600 feet. Crosscut adits were run later, the principal one cutting the vein 160 feet from the portal on Union Claim. A drift south from here for 250 feet on vein is still accessible for 175 feet. It gave backs of 80 feet on the vein, which has been stoped out nearly to surface except for one block about 90 feet long. The vein here dips 18° to 24° E. and is two feet to six feet or more in width. The hanging wall is black slaty schist, containing considerable graphite, and frequently much twisted and broken. The footwall is a decomposed, light-colored dike rock, common in the mines of the district. On the south side above drift, the hanging wall portion of vein, which is two to three feet wide, and separated from footwall portion by gouge, has been stoped. There remains on footwall an equal or greater width of vein containing quartz and brecciated fragments of slate. The vein has also been underhand stoped for about 70 feet on strike and 40 feet on dip. In the north drift which is 70 feet long, the vein is broken and narrow at the face. The dip of vein on this side suddenly steepens and it was followed down 25 feet or more by a winze, now full of water but said to show 11 inches of good ore.

Southward beyond the stoped ground a drift said to be 1100 feet long was run in search of the northward extension of the Klamath ore shoot, but this was not found. This is in the Union Extension claim. Near the north end line of Union claim a winze 20 feet long shows a

vein 1½ feet wide composed of quartz and 'slate' ribbon rock. Near this end also a crosscut was run 500 feet east but failed to develop ore.

It appears from observations of the steep topography, and the underground geologic conditions, that the developed portions of this and nearby veins in the same formation may be sections which have been bent over nearly flat and perhaps broken away from the remaining deeper sections of veins that were originally much steeper in dip. Movement of the mountain mass in a northwesterly direction due to gravity, would account for such a result, and the heavy gouges in the several mines would indicate that such movement is continuing.

At one time, 40 years ago, there was a 4-stamp mill on the property

but there is no equipment now. The ore in sight is low grade.

Vesa Creek Pocket Mine. Owners, Harry, Joseph and E. Davidson. This is on Vesa Creek, a tributary of the Klamath, 12 miles from Yreka. The owners have produced several thousand dollars from it in recent years.

Victoria Quartz Prospect. Owner, L. H. Brown, Dunsmuir. This contains 40 acres in Sec. 6, T. 39 N., R. 3 W., 1½ miles east of Mott. There are said to be thirteen veins on the claims, carrying gold, silver and copper. Several hundred feet of prospecting and development work has been done.

Bibl: Cal. State Min. Bur. R. XVII, p. 535.

Victory Gold Mines Company. A. M. Buley, president. Office 1104 Pacific Mutual Building, Los Angeles. John Nefroney, general manager. The company claims 11 unpatented quartz locations in sections 16, 17 and 20, T. 40 N., R. 10 W., and also owns the Advance Mine (which see, ante), adjacent to South Fork of Russian Creek three miles by road from Finley Camp and 22 miles from Etna Mills by road. The property extends from South Fork of Russian Creek, elevation 3400 feet to top of ridge between the two forks, nearly 2000 feet.

higher. Gazelle, the nearest railroad point, is 52 miles east.

Geological conditions are similar on these claims as far as opened, to those noted under Advance and Hardscrabble properties. Several belts of black schist, up to 50 feet wide, striking north to N. 20° E. and dipping steeply to the west, cross the property. Three of these noted by the writer carry quartz stringers and narrow veins running mostly parallel to the strike of the schist, and other such belts are reported on the property, but were not visited on account of lack of time. This series of schist belts has been opened at intervals on the Victory, Hardscrabble and Advance claims for nearly a mile along the strike, showing in place on all three properties with a practically identical strike and dip. The numerous dikes interbedded with the schist are prominent and are usually to be seen in the workings on the hanging wall side of those sections stated to carry the best ore. Some of these dikes carry noticeable amounts of pyrite. The black schist is probably derived from an older series of intrusive rock of basic character, with associated beds of limestone, and due to its structural weakness became the locus for shearing movements and for the deposition of quartz, calcite and gold of the ore after or contemporaneous with the injection of the later dikes, which are of several generations. This older schist series has been considered by some writers ' to be a series of metamorphosed sediments of Algonkian age; Professor J. P. Smith has grouped them all as "pre-Cambrian metamorphics" believing them to be partly igneous in origin. In this particular locality, they are notably high in hornblende, occasionally

show some graphite, and considerable calcite is in evidence.

Most of the work has been on the Bluebird ledge. Tunnel No. 1 is 250 feet long, 150 feet below the apex, and Tunnel No. 3 is 220 feet long with short crosscuts, and is 400 feet below No. 1. Two other short tunnels and several short open cuts have been opened along the strike, all this work being on the north side of South Russian Creek. A great number of assays are on file in the company's records showing high values, but as far as could be learned the method of sampling and assaying has not been such as to show average values of the widths of ore claimed, which range from three feet to 40 feet. A portable gasoline driven air compressor has been installed at No. 3 adit as the rock in depth becomes hard.

On Sourdough claim, east of above, work was done years ago and a few tons of ore packed to the Lanky Bob mill in Whites Gulch is said to have paid \$37 a ton. There are adits 175 and 160 feet and a shaft 55 feet deep, said to show a vein four feet wide, also a crosscut 300 feet long and considerable drifting on the vein. On the Peerless claim two crosscuts, 92 feet and 110 feet long, running toward the Bluebird ledge have not yet reached it. On Lena and Pauline claims assessment work only has been done. On the Humming Bird over 200 feet of work, including a shaft 79 feet deep, and a crosscut 120 feet long, is stated to have been done. Crosscuts have been started on Hardscrabble Extension No. 1 and No. 2 claims. On Marietta claim, on the Queen vein near the office, a black schist belt 50 feet wide has the usual dip and strike, carries quartz stringers and pans free gold at the surface, but no work has been done on it.

The widespread distribution of gold on these three adjoining groups of claims makes the area an interesting one, and it is to be regretted that no system of sampling and assaying has been adopted to show the operators the tonnage and value claimed to be in sight, although probably hundreds of random assays have been made. No work was being done on this property October 29th, but an early renewal of

operations was planned.

The property is equipped with a bunkhouse of 20 rooms, boarding house, garage, machine shop, carpenter shop, office and smaller buildings, all new and well made. A new electric power line  $15\frac{3}{8}$  miles long from Etna Mills has recently been completed to the property, also  $1\frac{1}{2}$  miles of secondary line. A second-hand 30-stamp mill has been brought to the claims, but not yet erected, as no building has been provided for it. There are also in storage on the property an electric locomotive, 30 ore cars, electric hoist, 40 electric motors ranging from 4 to 125 h.p. and a great quantity of other equipment and supplies. A Sullivan compressor, capacity 680 cu. ft. per min., has been installed, with 125-h.p. motor, and another of 460 cu. ft. per min. capacity is in storage, and company has three trucks of  $3\frac{1}{2}$ ,  $2\frac{1}{2}$  and 1 ton capacity.

¹ Hershey, O. H., Am. Geologist, Vol. 27, No. 4, pp. 225-245.

Water rights are claimed on South Russian Creek and Musick Creek.

Wanda Group. Owner, O. L. Palmer, Forks of Salmon. Comprises three claims on Grahams Gulch, tributary of South Fork of Salmon River, about seven miles southeast of Forks of Salmon, by trail.

A quartz vein from a few inches to six feet wide has been prospected by an adit and two shallow shafts, showing an average of four feet of quartz. In the fall of 1925 Palmer was reported to have about 100 tons of ore out ready for crushing and twice as much in sight. He contemplated the building of an arrastra. Water is available from Indian Creek or the river.

Wilson Brothers Prospect. Owners, Wilson Bros., Sawyers Bar. There are two quartz locations on the west side of Eddys Gulch, near Rollin P. O., at an elevation of 3400 to 3500 feet, and 3½ miles by road south of Sawyers Bar.

Several short adits have been run to develop a quartz vein similar geologically to those in the Ida May, Central and other mines nearby. The lowest adit is about 150 feet long, of which 36 feet of drift follows a vein from a few inches to three feet wide, in black slaty schist and on the contact of schist and a light colored dike. The vein strikes N. 70° E. here and dips south. Forty feet higher, a second adit was run about 170 feet, and about 36 feet is on the vein, which strikes nearly due east and dips 65° south. In the upper adit, which is 25 feet above the second, and is on the vein for 100 feet, the vein is enclosed between a heavy, broken lens of schist on the hanging wall and dike or 'cab' on the footwall.

The property is equipped with a 2-foot Chili mill and 6-inch rock-breaker, operated by 3-h.p. gasoline engine. A total of 130 tons of ore is reported to have yielded the owners \$2,000.

Wood Gold Prospect. Owners, Sam K., Stanley and Mrs. J. C. Wood, Mrs. Lena Hibbard and E. L. Brier, of Seiad P. O. This is a group of six quartz claims on Thompson Creek, ten miles by trail from the mouth. Thompson Creek enters the Klamath River 65 miles from Hornbrook by road. The claims were not visited, but samples shown carry pyrite, galena and free gold. A prospect adit had reached a depth of about 100 feet late in 1925. The vein is reported to be eighteen inches to two feet wide. There is no equipment on the claims.

## Gold Mines (Placer).

Since the passage of anti-debris legislation, and the decision of Judge Sawyer which put a stop to hydraulic mining in the Sierra Nevada Mountains in 1880, Siskiyou County, whose rivers are nonnavigable in their entire lengths, and drain little arable land, has shared with Trinity County the distinction of being the scene of all varieties of placer mining. Besides the advantage of being able to dump debris into the rivers unhindered, the placer miners of this county generally are able to get a good water supply, and have little trouble from rival claimants, such as power companies and irrigation and municipal water districts, which in the central part of the state have nearly completed the appropriation of available water in the mountains. Since

the world war increased operating costs, and also due to a succession of dry years, placer mining even in this favored region has not flourished as it did formerly. Of course this is due partly to the exhaustion of much good ground, but it is a fact that there remain in

the county several thousand acres of placer mining ground.

The Klamath and Salmon rivers have been and continue to be the principal placer mining districts. The geology of their bench deposits has been covered elsewhere herein. It is worth noticing that the richest districts have been in sections where gold can be traced to a nearby local source. The Hamburg Bar Diggings, below the mouth of Scott River, which was enriched from Scott Bar downstream by a seam belt; and the North Fork of Salmon River westward from the mouth of Eddys Gulch, which dumped into the river millions in gold from the quartz veins which were eroded into its upper branches, are striking examples of this. Local bedrock conditions, where wide belts of soft rock cross the river and are followed by hard reefs, have promoted the meandering tendency of the stream, aiding the formation of a series of bars, benches and back channels. The latter condition may be present without the former, resulting in accumulation of considerable low grade gravel, or spotty values, as in some sections between Hamburg and Happy Camp. A third set of conditions, where the river takes a course parallel to the general direction of schistosity of the country rock, results in the erosion of a steep, rocky canyon, with bench and bar deposits small or lacking. This latter condition exists downstream from Happy Camp to Orleans.

Gravel mining along the Klamath River has been quiet of late, but there is considerable new material to record herein regarding properties not previously covered in the Bureau's reports. More activity is to be noted on the Salmon, where a number of properties are working by the hydraulic process. Scott Bar and vicinity give promise of some work besides the Quartz Hill operations, where a pocket mine in the seam belt is being hydraulicked. The districts of Beaver Creek, Little Humbug, Callahan and Quartz Valley show small scale opera-

tion when water is available.

Abel W. Cook Placer Mine (Big Nugget P. M.). Owner, Abel W. Cook, Oak Bar. This comprises four placer claims of 20 acres each on Horse Creek, including its bed and bars for one mile in length, beginning five miles by road above the mouth. It is 42½ miles by road

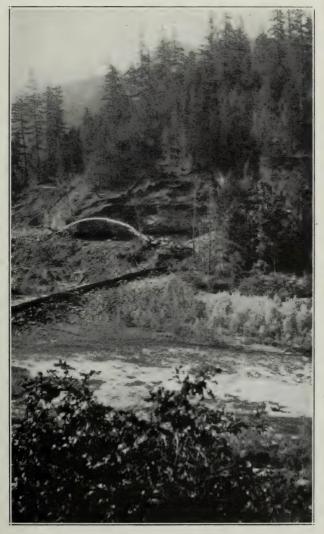
from Hornbrook, and at an elevation of 1950 feet.

The deposit is loose stream gravel nine feet deep on the upper end of mine and 70 to 80 feet wide. The creek is said to have remained unworked on account of the lack of grade and dump. Most of the pay is in the lower part of gravel in the stream channel, but all carries some gold and some nuggets up to \$18 each have been found. Cook has been on the property three years and has stripped the top gravel preparatory to mining with a self shooter to bedrock. The top gravel is said to have paid 60 cents a yard. Water is taken from the creek a short distance above the claims. The only equipment is sluice boxes and hand tools.

Anderson Placer (see Joubert Placer Mines).

Abe Lincoln Placer Mine is on the south side of Klamath River

nearly opposite the Portuguese Mine and has been worked a little by the same company. It is a gravel covered bench having a length of about 900 feet along the river and a width of 150 feet. The gravel is ten feet deep, with as much as 60 feet of overburden. The front rim is said to have paid when piped off some years ago for a width of



Abe Lincoln gravel prospect on Klamath River, near Sejad Valley.

50 feet, but one-half acre piped by the present company yielded only about \$1,000. They have also drifted for 400 feet along bedrock, finding a very narrow, thin paystreak. Bedrock is 25 feet above the present river. The small hydraulic outfit uses water from Portuguese Creek.

Ballingal Placer. Owner, R. F. Ballingal, Callahan. Includes several placer claims, unpatented, at the junction of Jackson Creek with the South Fork of Scott River, six miles south of Callahan, 41 miles of the distance being over a good road and the balance trail. Elevation is 4000 feet or more. The gravel lies between the two streams and may have been deposited by either of them when at a higher The bank is of moderate depth without overburden and there is a fairly good dump. There are some large boulders. characteristic of this section of the river, where the size of the wash is out of all proportion to the present size of the streams. A derrick would be required to handle these boulders. The gravel is free wash and has been ground sluiced in a small way by the owner, who has realized a small yearly return in coarse gold but has been able to handle only a very little gravel. Water is available under good head for hydraulicking and there are several acres that could be worked in the one piece, with other similar areas on the claims. Besides ground sluicing, Ballingal has done considerable prospecting underground with drifts. Parts of this ground were drifted in the earlier days when Callahan was a thriving placer mining camp.

Bibl: Cal. State Min. Bur. R. XX, p. 180.

Bark House Creek Placer. In Oak Bar district. Idle.

Bibl: Cal. State Min. Bur. R. XIV, p. 844.

Beaudry Placer Mine. In Secs. 3, 11, 34, 35, 30, 26, 2 and 23, T. 39 and 40 N., R. 8 and 9 W., in Callahan district on and adjacent to South Fork of Scott River, one mile southeast of Callahan. Owner,

Madam Angele Bazet, 4 Laguna Street, San Francisco.

This is the largest mining property in the district, containing 640 acres of patented land and controlling sufficient water from the river and nearby tributaries for large scale hydraulic mining. No mining has been done since the war. The property contains several old claims, worked in whole or in part many years ago by the predecessors of the present owner, and also a considerable area of unworked ground. The bedrock is schist and the gravel 20 to 60 feet deep, and values are spotted. Ditches 15 miles and two miles in length respectively, from South Fork of Scott River and Wildcat Creek have been kept in fair shape during the last period of idleness. There are several thousand feet of iron pipe and other hydraulic equipment and several buildings on the property.

Bibl: Cal. State Min. Bur. R. XIV, p. 844; Bull. 92, p. 99.

Belle Josephine (Slide Creek). Owner A. E. Westover, Callahan. Contains 160 acres on Slide Creek, six miles southwest of Callahan in Sec. 14, T. 39 N., R. 9 W. Is partly virgin ground and partly old claims worked years ago. Leased with option in 1925.

Bibl: Cal. State Min. Bur. R. XIV, p. 844.

Big Bend. Owners, H. J. Barton, James Allen et al., Yreka. Comprises 120 acres on Klamath River two miles west of Oak Bar.

This is thought to be a section of old channel covered by a slide. A tunnel was being run in the summer of 1925 to prospect it. Part of the ground was worked by J. Ross Wade several years ago.

Big Slide. In Sec. 19, T. 46 N., R. 8 W.

Bibl: Cal. State Min. Bur. R. XIV, p. 859.

Blaylock & Schon Placer is on a low bar of Klamath River just above Oak Bar on property belonging to Mrs. Mott. Two men have been working during the past season. An incline has been sunk into the old back channel and some production was said to have been made during the season.

Bloomer Mine. In Secs. 33, 34, T. 11 N., R. 7 E., six miles northwest of Forks of Salmon, and contains 51 acres. Owner, Bennett Company.

George Wm. Smith, manager, Forks of Salmon.

The deposit consists of from 20 feet to 40 feet of gravel in an old channel covered by 40 feet of clay and slide material, and lying about 200 feet above the present river. It has been partly worked out but has been idle for several years. A supply of 1000 inches of water was obtained from Nordheimer Creek for four months yearly, and the early operations, which were on a small scale, paid well as the ground was easy to work and averaged well in gold.

Bibl: Cal. State Min. Bur. R. XI, p. 426; XII, p. 278; XIII, p. 390; XIV, p. 844.

Blue Gravel (Black Lead). In Sec. 32, T. 45 N., R. 7 W., two miles south of Yreka.

Bibl: Cal. State Min. Bur. R. XIV, p. 844.

Blue Hill. In Sec. 16, T 45 N., R. 10 W., one-half mile south of Scott Bar. One 20 acre claim, idle.

Bibl: Cal. State Min. Bur. R. XIV, p. 845.

Blue Nose Mine. Owner, Blue Nose Mines Company, Blue Nose P. O. Comprises five unpatented claims in Sec. 5. T. 13 N., R. 6 E., H. M., on Klamath River 18 miles north of Somes Bar.

The deposit includes four benches of Klamath River about 60 feet apart. The gravel is loose, medium sized and about 20 feet deep with an overburden of 40 feet of country rock slide material, largely serpentine. The claims were located first 33 years ago. Norman Carter sold to Donald McPherson and the latter after doing a very little work sold to the company. Water from Carter Creek through three-fourths mile of ditch and flume, giving 430 feet pressure and a six months run, was used, and in 1919 the company applied for 45 cubic feet per second of the water of T-Bar Creek. This requires a dam and three miles of ditch. Operations have been on a small scale using two No. 3 Giants and 600 feet of sluice.

Boulder Creek Placer (Fippen & Hayden Mine). Owners, Fippen & Hayden, Callahan. It contains 60 acres, unpatented, three miles by road and trail south of Callahan on Boulder Creek.

A decomposed dike along the contact of serpentine and granite carries seams and veins of quartz. Some rough gold, occasionally

coarse, has been recovered from hydraulic mining operations in two small pits opened on the dike, the total area worked being perhaps two acres. The total production has been small.

The property is equipped with 150 feet of 8-inch and 11-inch pipe and one small giant. Water controlled by the McKeen Mine is bought for \$1 a year. The mine has two ditches, of which the lower, about two miles long, has been used recently and the upper has been allowed to go to ruin. The bank is getting high and the upper ditch will have to be put in use if much more piping is to be done.

As mentioned elsewhere, there is also a prospect of lead on these

claims.

Bibl: Cal. State Min. Bur. R. XX, p. 180.

Boulder Point. Owner, Joseph Weeks, Scott Bar. Little or no work recently on account of lack of water.

Bowersox Mine. Owner, W. P. Bowersox, Somes Bar. In Sec. 2, T. 11 N., R. 7 E., H. M., at Somes Bar. Contains 40 acres partly worked out, with 20 feet of gravel. It has been worked on only a limited scale in late years.

Bibl: Cal. State Min. Bur. R. XIV, p. 845.

Brazil. An old placer, 80 acres, in Hawkinsville district, Sec. 11, T. 45 N., R. 7 W. Ground sluicing and drift mining was done for many years. Gravel was 14' deep.

Bibl: Cal. State Min. Bur. R. VIII, p. 612; XIII, p. 391; XIV, p. 859.

Brown & George Mine. Address T. H. George, Cecilville. Hydraulic property in East Fork district.

Bibl: Cal. State Min. Bur. R. XII, p. 391; XIV, p. 845.

Burns Placer Mine (see Joubert Placer Mines).

Campbell Placer. Owner, H. A. Weed et al. Mineral Lots 42, 48, 29, 46 etc. in T. 43 N., R. 10 W., 394 acres; mineral rights to Lots 5, 6 and 7, in Sec. 11, T. 43 N., R. 10 W., containing 47 acres, and Mineral Lot 45, 81 acres in Sec. 13, T. 43 N., R. 10 W.

This is in Quartz Valley district and contains a large part of the

placer ground there. It has not been operated since 1910.

Bibl: Cal. State Min. Bur. R. XII, p. 279; R. XIII, p. 392; R. XIV, p. 845.

Carpenter and Robertson. Owners, S. Carpenter and E. M. Robertson, ('ecilville. Prospect in gravel at junction of East Fork and South Fork of Salmon River, near Cecilville.

Cecilville (Sightman) Placer Mine. Comprises 40 acres on Crawford Creek, near Cecilville. A small producer which was operated by G. H. Sightman for many years, using one giant and water from Crawford Creek.

Bibl: Cal. State Min. Bur. R. XIV, p. 845.

Classic Hill. In Sec. 36, T. 18 N., R. 6 E., H. M. This mine contains about 70 acres, patented, and 12 unpatented placer locations are

claimed. It is on Indian Creek 11 miles by road north of Happy Camp. In proportion to yardage handled, it was perhaps the best paying mine

in the district, but has been idle many years.

The deposit mined by hydraulicking is the upper oxidized and decomposed portion of a series of dikes carrying auriferous quartz seams and limestone in serpentine. This series is one-half mile or more wide traversing a well-defined saddle about N. 20° E. with serpentine on the east and basic dikes and mica schist on the west. When the bank became high in the later years of mining, operations were hindered by the serpentine swelling and rising in the cuts faster than it could be piped away so that little progress could be made. There is still considerable ground unmined.

The ditches are in poor shape. One six miles long giving enough water for one large giant under 140 feet head, needs a number of flumes. Another nine miles long lacks two miles of being finished. Both of them head in the West Fork of Indian Creek and would give ample water. There is little equipment and one building on the claims.

Conzetti Placer Mine. On upper South Fork of Salmon River, Cecilville district. Leased in part in 1922 to Lewis Roff, Almon Strickling, and Archie Farnsworth, who did some hydraulicking. Later reported leased to Thos. Meloney and Grant Bates. G. A. Conzetti, Cecilville, owner.

Crapo Placer Mine. Owner, Bennett Company. George Wm. Smith, manager, Forks of Salmon. Contains 39 acres, patented. In Sec. 11, T. 10 N., R. 7 E., three miles northwest of Forks of Salmon, on a high bench about 400 feet above Salmon River. Formerly worked with a supply of 1500 inches of water from Crapo Creek, and was a good producer but has been idle for many years. The gravel was 20 to 25 feet deep, with 20 feet to 60 feet of clayey overburden. Includes the Fort Beyers claim.

Bibl: Cal. State Min. Bur. R. XI, p. 427; XIII, p. 396; XIV, p. 846.

Croesus Placer Mine (Hickey). John Teukert, owner, Sawyers Bar. Contains 20 acres, an upper bench gravel claim on North Fork of Salmon River, 6½ miles west of Sawyers Bar. The gravel is covered with a heavy overburden and carries large granite boulders. Teukert operates it as an hydraulic mine, using water from nearby gulches, and the season is short.

Cronin Placer Mine (see Gallia Placer Mine).

Davis Consolidated Mines. Owner, Estate of Reeves Davis, deceased. Address W. F. Davis, Executor, 427 J street, Sacramento. The property contains 634 acres of patented ground and 265 acres of unpatented placer claims in Secs. 2, 11, 10, 15, 16, 21 and 22, T. 16 N., R. 7 E., H. M. The holdings extend along the Klamath River nearly three miles, including part of the town of Happy Camp, and placer mining ground on both banks of the river at the confluence of Indian Creek. Hornbrook, the nearest railroad point, is 76 miles easterly.

Mining began on the river frontage of this property in 1852, when there were many separate owners of claims, which were consolidated in 1899 by Rutgers Van Brunt under the title of Oregon Gold Mining and Water Power Company. Among the early operators were Raymond and Ely, who are stated to have produced \$40,000 in four seasons from Schoolhouse Flat, east of the river; and Ah Ock, who is said to have produced \$100,000 from the ranch portion of property, a mile and a half downstream from Happy Camp on the west side of the river. In three seasons, 1899–1902, the Van Brunt interests worked possibly 12½ acres by hydraulicking, and produced about \$70,000. The property was sold to Davis in 1908. During his operations he produced \$72,091 from 11.5 acres, according to his own records, quoted in his report on the property, from which the above is summarized. Davis' last work was done in 1919.

The gravel deposits upon this property consist of a series of three benches, representing former levels of the Pleistocene and Quaternary Klamath River having nearly the same gradient and course as the present stream. The bedrock is soft slaty schist and the three benches of gravel are 10 feet, 80 feet and 165 feet above the present river. The grade of the old channels is 15 feet per mile, three feet more than in the present stream. The gravel is tight, containing some boulders up to one-half ton in weight, and in places has been found cemented to the bedrock in small patches. The uppermost bench contains 30 feet of gravel, of which the lower six feet carry about one-half of the pay; above this is a layer of sandy clay and fine gravel, two feet to 40 feet deep, and this is covered by red clay soil sometimes up to 40 feet thick. The deposit on the second bench contains about 20 feet of gravel covered by 20 feet of sandy clay, and the first bench deposit is 20 feet deep. Remnants of the first bench occur at the southwest end, and part of the second bench at the northeast end. Davis' work was all done on the third bench, on west side.

Davis stated that the best pay and coarsest gold from the third bench was found in a series of gutters or sub-channels, which had been cut six feet to ten feet deeper than the rest of the bedrock on the bench. He

found 12 of these gutters, all parallel.

Two remaining sections of gravel, parts of the first and third benches, are occupied by the ranch property, one of the finest of the kind in the county. The third bench here is fully one-fourth mile wide, and one-half of the ranch area containing 60 acres of it has been prospected by drilling, the record of this indicating a gold content of \$5,290 per acre. There is claimed to be a total of 500 acres of

unmined gravel on the property.

Running adits across the channel on the bedrock or as near it as possible was found to be the most reliable way of prospecting. Preparatory to mining, all brush and timber was cleared off of several acres each season. When possible it was also desirable to pipe off in advance the red clay soil overburden. The gravel bank was undercut with the giant, caved and driven into the headrace and thence into the sluices. Four tons of dynamite for a season's run of eight acres were used to break up boulders. Sluice boxes were three feet wide and three feet deep, set on a six inch grade and paved with round pine blocks 11 inches thick. Only 300 feet of sluices were used, and there was no undercurrent, so there was probably considerable loss of fine gold. As the outer rim of the old channel is preserved, it was necessary to run sluice tunnels or cuts from the river bank above the

level of high water, through the rim up to the gravel bank on a grade of six inches in 12 feet. Such tunnels, to make available remaining

ground, would have to be 1000 feet to 2000 feet long.

This property has the first right to water out of South Fork of Indian Creek, a large tributary of Klamath River entering from the north. Sixteen miles of ditch and flume with a capacity of nearly 3000 miner's inches gives a head of 206 feet on the third bench. The dam, ditch and flume have been neglected for several years, and a large sum would be needed to rehabilitate them. If this supply were fully available, a maximum season of eight months would be possible in favorable years. The waters of Doolittle Creek can also be turned into this ditch four miles from the mine. A ditch two miles in length from Griders Creek was originally built to carry 1000 inches, but is also in bad shape.

The property is equipped with a sawmill, ranch buildings, and a large old hotel and other buildings in the town of Happy Camp. There is a good stand of timber on the claims. Mining equipment includes 3000 feet of large diameter pipe and two siphons (on ditch line), and 3000 feet of pipe from 15 inches in diameter down, at the

mine.

Dick Morris Placer (Joe Ramus Placer). Owners, J. B. Nowdesha and Mrs. S. D. Johnson, Hamburg Bar. Contains 59 acres, unpatented, in Sec. 35, T. 46 N., R. 11 W., 1½ miles west of Hamburg Bar on the south side of Klamath River.

This is a high bench from which perhaps five acres have been hydraulicked. The overburden is increasing rapidly to the southward. Most of the pay is in the lower part of the bank. Water for operating is scarce as the property has only a second right to water used by the adjoining Hammer Mine. One giant is used when water is plentiful. The present owners may drift on the bedrock if no water is available this winter.

Bibl: Cal. State Min. Bur. R. XIV, p. 848.

Doggett Mine. Near Oak Bar, on Klamath River. Worked out by A. C. Aiken and sold as a ranch in 1916.

Dunnigan Placer. In T-Bar Creek district, 36 miles south of Happy Camp. Deposit similar to Blue Nose property.

Bibl: Cal. State Min. Bur. R. XIV, p. 848.

Eastlick Mine. Owner, Reichman Mercantile Company, Fort Jones. In Secs. 7 and 8, T. 43 N., R. 9 W., in Oro Fino district. It was formerly a good producer but has been idle for many years.

Bibl: Cal. State Min. Bur. R. VIII, p. 608; XIII, p. 398; XIV, p. 848.

Elliott Placer Mine (Golden Nugget). Contains 20 acres on Jackass Gulch a mile and a half from Sawyers Bar. The gravel bank was 15 feet to 40 feet high and was worked years ago by the hydraulic process, but the property has been idle in recent years as most of the ground has been worked off and there is no equipment.

Bibl: Cal. State Min. Bur. R. XIV, p. 848.

Fir Tree Placer Mine. Owner, Bennett Company of Forks of Salmon. One 20-acre hydraulic claim on Salmon River one mile west of Forks of Salmon. This property has been idle a great many years. The company is plauning resumption of mining the present season on some of its claims in this vicinity, and at the forks.

Forks Placer Mine (McNeals Bar). Owner, Bennett Company of Forks of Salmon. George Wm. Smith, manager. Comprises 50.78 acres at and near Forks of Salmon. Mining has been done on the south side of main river adjacent to McNeals Creek and south of the confluence of the two forks of the river. Perhaps three or four acres have been hydraulicked opposite the town, across the river, the last work having been done by Forks of Salmon Placer Mining Company in 1923–24.



Forks of Salmon River Hydraulic Mine, at Forks of Salmon, Siskiyou County.

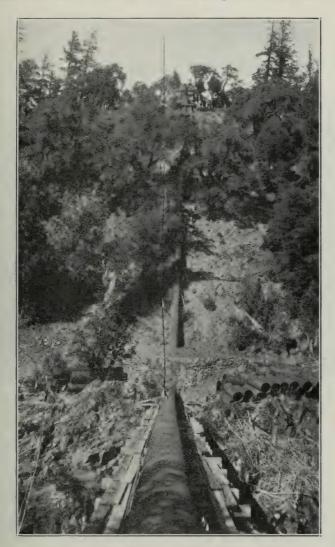
The gravel is 30 feet to 40 feet deep, mostly fine to medium size, free wash, with few large boulders, with only one or two feet of soil overburden. It lies on the first bench above the stream and has about ten feet dump directly into the river, which in this district is relied upon to clear itself several times each season in storm periods. The bedrock is schist and limestone.

Six miles of flume formerly used to bring water from the North Fork to Bonaly Mine was being repaired (Oct. 1925) to bring water upon this and other mines of the Bennett Company, who plan to work here and a mile farther down the river the coming season. The old company's water supply was 3800 inches with a season of ten months.

Bibl: Cal. State Min. Bur. R. XII, p. 287; XIII, p. 401; XIV, p. 849.

Frazier Placer Mine (see Woodfill and Barry Mine).

Gallia Placer Mine (formerly Paddy Cronin Mine). Owner, A. Jacquemart, 320 Market Street, San Francisco. E. Jacquemart, superintendent, Sawyers Bar. Property contains 120 acres, with a frontage of one-half mile and width of 750 feet along the north bank of North



Pipe line, Forks of Salmon River Hydraulic Mine.

Fork of Salmon River, and a 20-acre bench claim on south side, 4.6 miles by road west of Sawyers Bar. Elevation 1900 feet.

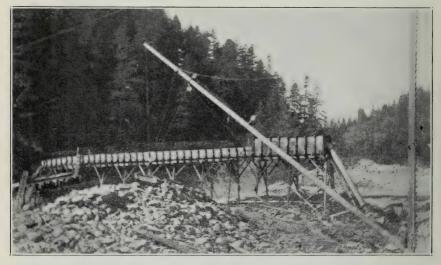
The deposit on north side is a back channel of the North Fork, little, if any, higher than the present stream. It is covered by 15 feet of barren granite sand and contains some large boulders of granite

brought in from the north side, as well as the river wash. The depth

of gravel is 20 feet.

The mine was worked in a small way only in the past because of lack of water. An ample water supply formerly used at the adjacent Red Hill Mine was acquired in 1924. Four thousand inches under 315 feet head is claimed to be available for as long as nine months in favorable years. The supply comes from Little North Fork of Salmon River, through four miles of flume and 6200 feet of iron pipe, including one-fourth mile of main pipe line, from 24 inches to 48 inches in diameter.

The ground is worked by hydraulic process, using two bank giants, a Hendy hydraulic elevator and a dump giant to clear tailings from in front of the sluices. The elevator has a vertical lift of 34 feet and the elevator giant uses 1000 inches of water. The capacity is 250



Elevator, flume and derrick, Jacquemart Hydraulic Mine, on Salmon River.

Photo by courtesy of Jacquemart & Son.

cubic yards a day. Elevator discharges into a flume 3' by 5' in cross section and 120 feet long, with improved riffles and undercurrent. A Pelton wheel operates a derrick for hoisting boulders from the sump. The sluice dumps into the river, which disposes of accumulated tailings in periods of high water. Five or six men are employed and it is hoped that when in full operation the ground can be worked for 15 cents a cubic yard. E. Jacquemart reports that in 1924–25, when operations did not reach full time on account of various delays and adjustments incidental to new work, 20,000 cubic yards were mined which paid one dollar a yard.

The property is well equipped with several new dwellings, shop

buildings, garage and electric lighting plant.

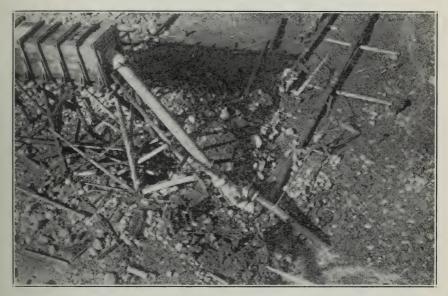
Gearhart Placer. Owner, H. J. Barton, Yreka. Contains 120 acres, along Horse Creek for a length of one mile, beginning four miles above the mouth of the creek, at an elevation of 1850 feet. Hornbrook is 41 miles distant.

This deposit is similar to the Abel W. Cook Mine (which see) and is nearby and downstream from it. It has been worked irregularly in a small way for many years. Lately the ditch 3½ miles long has been allowed to go to ruin.

Geeshan and Kellner Placer Mine. Owners dead, property idle.

Bibl: Cal. State Min. Bur. R. XIV, p. 850.

Gibson Bar Drift Mine. Owners, Joe Davidson and J. J. Skehan, Gottville. A 20-acre placer claim, unpatented, in SE4 of Sec. 6, T. 46 N., R. 7 W., two miles east of Gottville on an old bar of Klamath River.



Hydraulic elevator at Jacquemart Hydraulic Mine, five miles west of Sawyers Bar, on Salmon River, Siskiyou County, showing method of installing elevator, supply pipe, etc. The elevator section is 20 feet long, and suction joint, etc., 9 feet. Photo by courtesy of Jacquemart & Son.

The owners were sinking an incline, going down on the bedrock and had reached a depth of 60 feet on the slope or 36 feet vertical late in October, 1925. A 4-h.p. gas engine, No. 3 Hooker pump and small hoist were in use. The ground is supposed to be mostly virgin on bedrock.

Gold Bank Placer Mine (see Woodfill and Barry Mine).

Gold Hill Placer Mine. Owners, Bigelow Brothers, Sawyers Bar. Formerly a good producer, but about worked out and idle. Is adjacent to Sawyers Bar townsite, on a bench of North Fork of Salmon River.

Bibl: Cal. State Min. Bur. R. XIV, p. 850.

Gold Leaf Placer. Owner, Charles Dillstrom, Yreka. One placer location in Sec. 8, T. 45 N., R. 8 W. in Hawkinsville district,

The gravel has a maximum depth of 20 feet and is sluiced wth water from Long Gulch, but the water supply is limited, and little has been done by the present owner.

Golden Rule and Scott Bar Claims. Owners, Turner Brothers, Yreka. Two placer claims containing 40 acres on hillside on west side of Scott River at Scott Bar. This property is one of a number of so-called 'seam diggings,' on a belt crossing Scott River at this point. Part of the ground, reported to be about six acres, has been worked. Very little water is available. The Bilberry Lakes, about an acre in area, could be used for small scale work. There is one giant and 400 feet of 9-inch and 15-inch pipe on the claims. Idle.

Grider Mine. In Seiad district, on Klamath River nine miles west

of Hamburg Bar in Secs. 10, 11 et al., T. 46 N., R. 12 W.

Formerly operated as a hydraulic mine, but has been idle many years and was recently sold to Garrett for ranch and resort purposes. It contains unworked bench deposits.

Hammer Placer. In Sec. 36, T. 45 N., R. 11 W., and adjoining, one-half mile west of Hamburg Bar. Owners, Johnson et al., Hamburg Bar. This is a bench gravel mine on south side of Klamath River. Has been worked irregularly in late years. Water is obtained from Kuntz and Mill Creeks through three miles of ditch, and there is hydraulic equipment and a dwelling.

Bibl: Cal. State Min. Bur. R. XIV, p. 851.

Hoosier Hill Placer (Willard Drift Mine). Owner, J. B. Nowdesha, Hamburg Bar. Twenty acres, in Sec. 36, T. 46 N., R. 11 W., one-half mile west of Hamburg Bar on south side of Klamath River. This is a high bench claim, mostly hydraulicked years ago and idle the past 10 years. There is no water right or outfit for hydraulicking now, but Nowdesha thinks some drifting ground remains. An adit is in 30 or 40 feet.

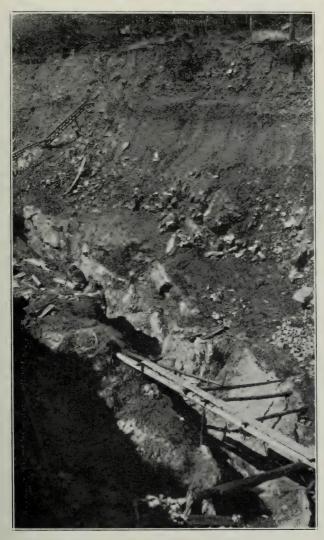
Imperial Heights Mine. Owner, Ed Hickey, Sawyers Bar. Contains 40 acres, on North Fork of Salmon River two miles west of Sawyers Bar. Deposit contains 20 to 80 feet of gravel and has been worked in a small way for many years by Hickey as a hydraulic mine, using water taken through a ditch from Shiltos Creek.

Bibl: Cal. State Min. Bur. R. XIV, p. 852; XII, p. 284.

Joubert Placer Mines (formerly Peterson Mine and includes Wm. Burns, Anderson, Late Discovery, David Casey, Upper Manuel, and Stevens placer claims). It is being purchased by L. J. Joubert of Sawyers Bar from John R. Peterson. Contains 87 acres of which about one-half has been worked by ground sluicing and hydraulicking. The property extends for a length of two miles along Eddys Gulch, beginning 1500 feet upstream from the Woodfill and Barry Placer Mine, and is  $2\frac{1}{2}$  to 3 miles from Sawyers Bar. Elevation, 2500 feet.

The deposit is loose, unassorted gulch gravel (see photograph), containing many slabby, angular rocks. The bedrock is mostly schist, some of it black and slaty, being the same formations found in the adjoining quartz mines. The bank averages 40 feet with a maximum height of 60 feet, of which about 25 feet is pay gravel. Large

rocks are stacked by a derrick, and the freshets in the gulch are relied upon to carry off the accumulated tailings below the boxes two or three times each season. A supply of 400 miner's inches of water, taken from both forks of Eddys Gulch through one-half mile of ditch



Joubert Hydraulic Mine, on Eddys Gulch, near Sawyers Bar, Siskiyou County, showing bedrock cut and unassorted, angular character of wash.

and 300 feet of flume and under 140 feet head is used for hydraulicking. With a new cut made this summer, and other improvements, Jouhert hopes to be able to handle about 30,000 cubic yards of gravel yearly, provided water conditions permit a working season of six to eight months.

The property was worked for many years by Peterson, and previously by others. Peterson's figures show he mined a total of 120,250 cubic yards by hydraulicking and ground sluicing, recovering \$47,300 or a reported average of 39.3 cents a cubic yard. He also produced \$9,000 by drift mining, but there is no record of amount of previous output. Joubert has been operating the property two years and reports having handled 27,673 cubic yards during 175 days piping in the season of 1924–25. Reported cost was 12 cents a yard. Yield was good and operation profitable, although the average per yard was less than that reported by Peterson. Four to six men were employed.

Joubert estimates there are 550,000 cubic yards remaining that can be hydraulicked. The basin drained by Eddys Gulch contains only seven to eight square miles and is surrounded on three sides by high mountains. There is a good dam site available on this property, and the utilization of this would permit a longer season, as the water

flow now ends suddenly with the disappearance of snow.

The placers of Eddys Gulch were fed from the erosion of the numerous auriferous quartz veins which lie in the basin, among which are the Klamath-Central-Ball vein system, the Ida May, Boss, and other veins. The gold in the placers is often coarse, rough and still attached to quartz. The wide U-shaped gulch and the angular character of the filling give the impression that it is an old glacial trough, although this is not known to have been definitely proved. The placer mines of Eddys Gulch have a reputed output of \$3,000,000.

Long Tom Placer Group. Owner, Judin Johnson, Sawyers Bar. Contains 15 acres, patented, in NE¹/₄ Sec. 35, T. 40 N., R. 11 W., and seven unpatented placer locations extending along Whites Gulch for 1½ miles, and 3 to 4 miles east of Sawyers Bar by road and trail. Under

lease and option to Eric K. Craig, Piedmont, California.

Many auriferous quartz veins have been worked in the mountains surrounding Whites Gulch and the erosion of such veins has fed the placers in the gulch, which are otherwise similar to the deposits in Eddys Gulch. The character of the wash is loose and angular, it contains a great many rocks and it is reported to average 20 feet to 25 feet deep. The exact acreage is unknown as the bed of the creek has been worked and some of the higher ground has been drifted, but there are estimated to be 15 acres of hydraulic ground and tests by Craig indicated a value of 25 cents a cubic yard. There is not much dump, and large rocks must be stacked.

There are two miles of ditch, 1500 feet of 9" and 11" pipe and two giants. Johnson claims a supply of 800 inches of water from Whites Gulch, with a fall of 250 feet and a water season of about six months. The claims have recently been fitted up for hydraulick-

ing, and there are two good houses and other buildings.

Lowden Placer. Owner, J. F. Lowden, Hamburg Bar. This is a hydraulic mine two miles west of Hamburg Bar on a high bench on the south side of Klamath River. The owner has worked for many years on a limited scale.

Lowden Placer. Owner, Ariel Lowden, Seiad P. O. Comprises 393 acres, patented, in Secs. 11, 12 and 14, T. 46 N., R. 12 W., in Seiad

Valley on both sides of Klamath River, 56 miles from Hornbrook by road.

This is one of the larger holdings along the river. It occupies an old back channel of Klamath River and the delta of Seiad Creek, entering from the north. It has been hydraulicked in years past and results were reported good, but it has lain idle for some time. One hydraulic pit on the north side of river shows quite a heavy red soil everburden and it is said bedrock was not reached on account of water and lack of dump. This property has been mentioned as a dredging possibility but no data are available as to the gold content.

Lucky Bob Drift Mine. Owner, Joseph Freshour, Gottville. One 20-acre placer claim on north side of Klamath River near Gottville. Has been worked irregularly as a drift mine for many years and has been

a small producer.

It was being operated under lease by Joseph Freshour, Jr., and three partners in October, 1925. There is a shaft 60 feet deep with a steam hoist and pump operated by gasoline engine. Pay gravel is breasted about six feet high and good ground runs \$5 a cubic yard with best on bedrock, but ground is spotty at most of the mines of this class along this part of the river. Work is going on in a drift 125 feet long, south of shaft.

Mann and Ross Drift Mine (Reynolds Creek Mine). Owners, Ed. Mann and Nelson Ross, Orleans P. O. In Sec. 21, T. 12 N., R. 6 E., H. M., on Klamath River 13 miles north of Orleans. It contains five placer claims of which two were bought from Wm. Lord in 1914

and three located by the owners.

This deposit is a type of which there are many examples between Orleans and Happy Camp. The ground drifted is the first bench, about 20 feet above the Klamath. The bedrock is slate close to the river, but serpentine farther back. The gravel is loose, heavy wash of slate, granodiorite and amphibolite. There is a heavy overburden of slide material. The owners attempted at first to work by hydraulicking, but the canyon sides are steep and serpentine naturally prone to slide, so that the overlying country rock slid into the workings to such an extent that they could make no headway. A little hydraulicking, for one or two months in winter, has been done and drifting paid fairly well. Some platinum has been produced. Water is obtained from Reynolds Creek through a short pipe line.

Maplesden Mine. On north side of Klamath River, three miles west of Hamburg Bar. Most of it has been worked out and it is idle.

Mary Alma Claim. Owner, Carl T. Frey, Seiad. One hydraulic claim in Sec. 10, T. 46 N., R. 12 W., near Seiad, on Klamath River.

This is a low bar which was worked to water level by Chinese in early days.

Masonic Bar Claims. Owner, Walter M. Creed, Seiad P. O. Contain 28 acres patented and 80 acres unpatented in Sec. 4, T. 46 N., R. 12 W., 2½ miles west of Seiad on south side of Klamath River. The patented land is valuable for farming and has not been prospected for mining recently, but is too low for hydraulicking. It was partly worked in early days.



Maplesden Hydraulic Mine, on north side of Klamath River, near Hamburg Bar.



Masonic Bar Gravel prospect on south bank of Klamath River, near Seiad Valley.

The higher ground has been hydraulicked in a small way by various lessees. Water is taken from Grider Creek through 3½ miles of ditch, 1000 miners inches being claimed although the ditch has not this capacity. The water has a fall of 90 feet at the mine.

McCann Placer. Owner, F. B. McCann, Happy Camp. One 20-acre placer claim on the west side of Klamath River, nine miles south of

Happy Camp, adjoining the Jerry Lane patent on the south.

This is a bench deposit, on the first bench above the present river. Such prospecting as has been done has indicated a satisfactory gold content, and there is sufficient gravel in sight for one or two men working several years, between the river and the highway. In spite of the mineral character of the land, the Forest Service has been contesting McCann's claim. Only assessment work is being done. The Little Anita Quartz Claim, belonging to the same owner, adjoins on the southwest. This shows a well defined quartz vein striking northwest between diorite and black slate walls. It has been developed by a series of open cuts and pits.

McCook Placer. Owner, Charles Benback, Yreka. Contains 24 acres in Sec. 1, T. 45 N., R. 8 W., in Humbug district, at an elevation of 2660 feet.

Benback bought the claim in 1920 and has worked alone, sluicing the gravel. A derrick for handling boulders is operated by an overshot water wheel, using water from the creek.

Michigan-Salmon Hydraulic Mine (Red Hill). Owner, Bennett Company, Forks of Salmon. Located on South Fork of Salmon River, extending along the stream from 1½ to 5 miles southeast of Forks of Salmon, and contains 600 acres, covering the bed, bars and benches of gravel along the river.

This was worked at intervals for over 25 years. The last operators were Michigan-Salmon Mining Company, who worked until about 1919. The earlier miners worked the high bench deposits. The last work done was on the gravel of the lowest bench, only a few feet above

the water. The deposit was about 27 feet deep.

The company used Ruble elevators on account of lack of grade and dump room. The elevator was 90 feet long, 81 feet wide and with sides six feet high. It was essentially a long sluice box set with the bed at an angle of 17° from horizontal, and the gravel was driven through the box against this grade to elevate it. The bottom of the box for 62 feet was a grizzley fitted with cross riffles of 2" x 4" lumber, iron faced and set two inches apart. Under the grizzley and at right angles to the length of the elevator, was a wide sluice 50 feet long to receive material passing through the grizzley. Three No. 3 giants using water under 457 feet head, were used, one exclusively for driving gravel through the elevator. Cobbles too coarse to go through the grizzley were driven over the upper end There was no soil overburden and not many large boulders, and the elevator handled 1000 to 2000 cubic yards of gravel in 24 hours, at a reported cost of 6 cents a yard, previous to the war. For a detailed description of the operation of the Ruble elevator, the reader should refer to our Bulletin 92, Gold Placers of California, pp. 45-47, by Charles S. Halev.

Morganza Drift Mine. E. W. Morgan, owner, Oak Bar. Three placer claims in Sec. 13, T. 46 N., R. 10 W., a mile and one-half west of Oak Bar, on a section of old back channel on south side of Klamath River, at an elevation of 1260 feet. J. A. Gilkerson and three others were prospecting the ground in October, 1925. An incline 100 feet long reaches a vertical depth of 30 feet, then turns down the bedrock, following the rim for 60 feet on the incline, or 15 feet vertical. This work is in gravel from which some prospects had been obtained, but the trough of the old channel had not yet been reached.

A small pump, operated by a 3-h.p. gasoline engine and a hoist operated by an automobile engine, were in use.

Multum in Parvo Placer Mine. Owners, Wm. Wike and Samuel Mathis of Sawyers Bar. Comprises three claims, Good Hope, Multum in Parvo Nos. 1 and 2, on the south side of North Fork of Salmon River, 5½ miles west of Sawyers Bar. The bench deposits were discovered in 1912–13 by George D. Carter who sold to the present owners in 1917. There are two benches of gravel, one 90 feet above the present stream, carrying 20 feet of gravel and 80 to 90 feet of red clay overburden, and the second 200 feet perpendicularly above the river. There was perhaps 2000 feet in length of gravel when first opened.

The supply of water, limited in amount and under 200 feet head, permits about seven months run in a good season. The mine has been worked by the partners using a No. 2 giant and has produced a few thousand dollars annually when water has been available. The bank is steep, and during the last work in 1924–25 a slide came into the

pit, blocking operations.

Native Son Placer Mine. Owner, M. L. Mills, Forks of Salmon. Comprises 20 acres, one mile northeast of Forks of Salmon, on North Fork. Idle.

Bibl: Cal. State Min. Bur. R. XIV, p. 854.

New Era Mine (Lower Siskiyou Mine). Owner, W. J. Brown, Happy Camp. In Sec. 19, T. 15 N., R. 7 E., at an elevation of 1000 feet on Klamath River, 12½ miles south of Happy Camp. Contains 160 acres.

This forms part of the extensive holdings once operated by Siskiyou Mining Company and is made up of a series of benches from the river to an elevation of 500 feet above it. The company operated it as an hydraclic mine, using water from Clear Creek through 11 miles of ditch and a smaller supply from Crawford Creek through two miles of ditch. The bank ranged from 50 to 150 feet high. The company began operating about 1895 and Brown came into possession of the ground in 1914. He is doing assessment work only.

Nigger Hill Placer Mine. Owner, Bennett Company, Forks of Salmon. Contains 80 acres, patented, in Secs. 20, 21, 28, 29, T. 10 N., R. 8 E., H. M. It lies on Niggerville Creek at an elevation of 2000 feet, and 2½ miles by trail from Forks of Salmon.

The property extends for one-half mile along the creek above its

mouth. The deposit consists of terrace gravels principally, with some low bars worked in the early days. The more recent workings have been on both sides of the creek nearly one-half mile upstream from the South Fork of Salmon River. Two old bench deposits have been mined. The highest one is about 300 feet above the present river, and appears to be the oldest gravel in the basin. It probably corresponds with the oldest of the five benches near Cecilville, which is 250 feet above the river. There is a bank 90 feet high, containing 30 feet of slightly cemented gravel at the base, overlain by 60 feet of a distinctly red, clayey overburden. The boulders in the gravel are medium sized and have the appearance of great age and the bedrock is soft and highly altered.

There has been little work done since 1916, when G. McNeill took out about \$1,600 in gold and 46 pennyweights of platinum group metals in a three months run from about one-third acre on the north side of creek. Three acres had previously been worked on the south side. The property has been of interest because metals of the platinum group, many pieces ranging in weight from a pennyweight to one-fourth ounce, were found by McNeill. Niggerville Creek drains

part of a large area of serpentine.

Nolan Gulch Placer. Owner, Charles Crutchfield, Callahan. On South Fork of Scott River, near its head in Sec. 14, T. 39 N., R. 9 W. While ground sluicing in open cuts, Crutchfield has found quartz gold and is lately reported to have uncovered a quartz vein one to four feet wide, carrying a very good prospect.

Nordheimer Placer Mine. Owner, Nordheimer Mining Company. H. B. Morey, Menlo Park, secretary. Comprises 60 acres, patented, on Salmon River, five miles by road northwest of Forks of Salmon. Deposit is 15 to 35 feet deep, and the dump room is small, as the surface of deposit is only 50 feet to 75 feet above the river. The water supply is about 1000 inches in a good season, from Nordheimer Creek, and permits seven months work. The mine has been idle for many years. It was leased a short time in 1924 but no production made. The ground, largely mined off, paid up to \$8,000 an acre.

Oak Bottom Placer Syndicate. Owner, Robert L. Younger, of Somes Bar, California, and Medford, Oregon. In Secs. 21, 32, T. 12 N., R. 7 E.; Sec. 6, T. 11 N., R. 7 E.; Secs. 1 and 2, T. 11 N., R. 6 E., and Secs. 35, 36, T. 12 N., R. 6 E., H. M., on Salmon River and Wooley Creek, east and north of Somes Bar. The property, containing over 480 acres, was made the basis of a proposed hydraulic mining project by John Nefroney in 1922, but was abandoned before reaching operation. It was stated water for hydraulicking could not be obtained because of previous appropriation by Electro Metals Company.

O'Neill Ranch Placer. Owner, B. J. Getchell, Hamburg Bar. Has a frontage of about three-fourths mile along both sides of Klamath River, but mostly on the south side in Secs. 22 and 27, T. 46 N., R. 11 W., 3½ miles by road west of Hamburg Bar. It was worked in early

¹ Logan, C. A., Platinum and Allied Metals in California, Cal. State Min. Bur. Bull. 85, p. 79.

days, but lately has been devoted to farming, no mining having been done in the last five years. The ground has the first rights to water from O'Neill Creek.

Orcutt Placer Mine. Owner, Alvin Orcutt, Forks of Salmon. Comprises 20 acres in SE4 of Sec. 30, T. 39 N., R. 11 W., M. D. M., at the mouth of Methodist Creek, seven miles by trail southeast of Forks of Salmon.

Loose bar and bench gravels, 10 to 20 feet deep, and 300 feet wide, carrying heavy boulders and lying on rough serpentine bedrock, have been hydraulicked by the owner on a small scale for many years. Water is brought through a ditch one mile long from Methodist Creek and the supply is sufficient for one small giant for a season not exceeding six months.

Paddy Cronin Placer Mine (see Gallia Mine).

Paine Mine. Owner, Wm. Fridley, Scott Bar. An hydraulic claim in Scott Bar district, one of the few in the district recently active.

Paradise Flat Placer Mine. Owner, Robert Younger. Forty acres along North Fork of Salmon River, just west of Sawyers Bar. Reported worked out.

Parker Placer. Owner, George J. Parker, Copper P. O. Two placer claims on Elliott Creek, in Sec. 20 or 21, T. 48 N., R. 11 W. Jackson-ville, Oregon, is the nearest town. The owner has been working alone. He also has six copper claims on which 200 feet of prospect adits have been run.

Pennsylvania Placer. Owner, Frank Edwards, Copper P. O. Comprises six placer claims on Elliott Creek in T. 48 N., R. 11 W., near the Oregon line. The owner has done only assessment work.

Peterson Placer Mine (see Joubert Placer Mines).

Pine Grove Placer. In Sec. 10, T. 46 N., R. 9 W., in Oak Bar district. Formerly productive, but idle in late years.

Bibl: Cal. State Min. Bur. R. XIV, p. 854.

Pond Water Mine. Owner, H. H. Albars, Blue Nose P. O. One placer claim in Sec. 20, T. 13 N., R. 6 E., H. M., at an elevation of 600 feet.

Assessment work only reported done recently. Water for hydraulicking is obtained from Sandy Bar Creek.

Portuguese Mine. Owner, Henry Wood, Seiad P. O. Contains 18 acres patented, and some unpatented placer claims on the north side of Klamath River in Sec. 4, T. 46 N., R. 12 W.

The deposit has been worked intermittently for many years and for four years has been leased with option to a company represented by Thomas H. Hurburt, 422 Second Street, Portland, Oregon. The front rim of this bench ground is said to have paid, but the recent operations on the back rim have been unprofitable. The bank on back rim contains 12 feet of gravel overlain by as much as 90 feet of red clayey overburden, which in places is cemented, hampering hydraulic operations. The pay is in the lower section near bedrock.

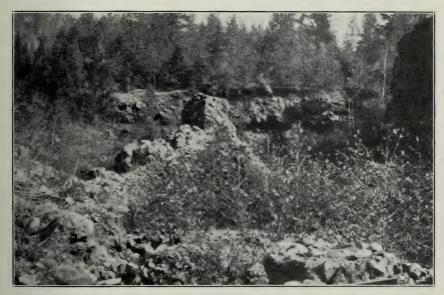
Water for mining is taken from Portuguese Creek and in favorable years the water season extends from November to May.

Bibl: Cal. State Min. Bur. R. XIV, p. 855; R. XIII, p. 420; R. VIII, p. 595.

Quartz Gulch (Wingate Hill) Placer. In Secs. 5 and 6, T. 15 N., R. 7 E., H. M., on Klamath River, eight miles southwest of Happy Camp by road. Some work was planned at this old property for the present season. It was formerly a producer.

Bibl: Cal. State Min. Bur. R. VIII, p. 601; R. XIV, p. 855.

Quartz Hill Mine. Owner, Harry G. Noonan, Apt. 12, 2801 Jackson Street, San Francisco. Mineral Lots 37 and 47 in Sec. 16, T. 45



Bank of gravel at Portuguese Hydraulic Mine, near Seiad Valley, showing unassorted and cemented character of red clay overburden.

N., R. 10 W., containing 75 acres in Scott Bar district adjoining town of Scott Bar. George Noonan, superintendent.

This is one of the oldest active mines in the county. It has been known since 1852 and has been worked by the present owners for 18 years. It is a deposit of auriferous quartz stringers and veins in schist. The upper portion was decomposed, and was worked as an hydraulic mine for many years. Then a stamp mill was put on it and a shaft was sunk about 75 feet. In later years, hydraulic mining has been resumed. The quartz stringer lead lies in bluish and grey schist associated with other metamorphic rocks, between dikes said to run parallel across the country in a northeasterly direction 1800 feet apart. The best pay seems to occur in the bluish schist. At the present time the work has reached the fresh hard rock, and there is no doubt that much of the gold goes out of the sluice onto the dump in unbroken quartz and schist.

The present work is 650 feet above Scott River. The water season is about 14 weeks annually, during which time about 1000 miners inches of water under 400 feet fall is used for piping. Besides hydraulic equipment, there is a 9" by 8" air compressor and drills for breaking bedrock and boulders. The sluice is 108 feet long, two feet wide and 30 inches high and is floored with iron riffles. The gold is rough, pocket quartz gold. A close watch is kept and rich rock is picked out and crushed. The schist carries a good deal of sulphides, principally pyrite with some galena. There is sufficient dump room between the sluice and the river for storage of the rock, although each year the river washes away part of it. The dump has interesting possibilities as a quartz milling proposition, although nothing definite is known of its average gold content because of the pockety character of the deposit. The property is a profitable one, and the principal producer of the district. Returns are at times sensational, as in the spring of 1925, when \$16,000 was said to have been produced in a few days.

Reeves Ranch. Owner, Minnie Reeves, Happy Camp. This is one of the largest holdings of placer ground remaining on the Klamath River. It comprises several hundred acres, of which a large portion is made up of low bar and bench gravels, on the north side of Klamath River, beginning just east of the town of Happy Camp, and extending for some distance along the river. It has been held for many years as ranch and farm land.

Rocky Point Mine. Owners, Hicks and McCarthy of Scott Bar. In SE₄ of Sec. 32, T. 45 N., R. 10 W.,  $3\frac{1}{2}$  miles south of Scott Bar.

This is an hydraulic claim, not worked on a very large scale due to lack of water for several years.

Roxbury Placer Mine. Owner, Roxbury Syndicate. Agent, George Milne, Fort Jones.

Property is a high deposit of gravel, on Scott River, one-half mile above the mouth. Haley ¹ mentions it as "one of the most interesting hydraulic propositions in California today." According to Haley, "There are in the neighborhood of five to ten million yards of gravel, which will probably mun from ton to fifteen costs a word."

which will probably run from ten to fifteen cents a yard."

In 1919, the Roxbury company applied for the right to the water of Kelsey and Canyon creeks. About 12 miles of ditch are still needed to give a supply of 2500 miners inches from Thompson, Middle, Kelsey and Canyon creeks. The present supply is said to be sufficient only to operate three four-inch giants, running six hours daily between January and July of a favorable season.

The property was leased to Hammer Brothers in 1921 but was idle and no one on the ground when visited in 1925. It has considerable

hydraulic equipment and some good buildings.

Rulon Placer. Owner, Percy Rulon. This is a placer mine on Beaver Creek.

Haley, C. S., Gold placers of California: Cal. State Min. Bur. Bull. 92, p. 98, 1923.

Russell Mine. Owner, Geo. Russell, Blue Nose P. O. In Sec. 30, T. 13 N., R. 6 E., H. M., thirty miles by road south of Happy Camp, at an elevation of about 775 feet. It is a small bydraulic mine, which has been operated only 2 or 3 months annually on account of lack of water.

Russian Hill Placer Mine (Red Hill). Owner, Estate of  $\Lambda$ . Ahlgren, Sawyers Bar. Comprises 80 acres on north side of North Fork of Salmon River,  $4\frac{1}{2}$  miles west of Sawyers Bar. This property was worked by the hydraulic process and is said to have produced \$350,000 from high bench gravel. It has been worked out, and idle for several years.

Rycroft Placer. In Sec. 14, T. 39 N., R. 9 W.,  $6\frac{1}{2}$  miles southwest of Callahan on Slide Creek. It was formerly productive but has been idle lately.

Bibl: Cal. State Min. Bur. R. XIII, p. 423; XIV, p. 855.

Sanford & Edmundson Claim. Owners, O. A. Sanford and T. A. Edmundson, Seiad P. O. This is a bench gravel claim on the south side of Klamath River near Seiad. It is not equipped and only assessment work has been done recently.

Sauerkraut Placer Mine. Owner, Charles Lilly. Forty acres on Salmon River, six miles by road northwest of Forks of Salmon, at an elevation of 1100 feet. This mine was hydraulicked by Chinese 30 to 35 years ago, and produced a few thousand dollars annually. It has been idle in late years. Water supply was obtained from Morehouse Creek.

Schuler Mine. Lessee, James W. Reynolds, Happy Camp. This is an hydraulic mine on Klamath River two miles upstream from Happy Camp, on the north side of the river adjoining the Minnie Reeves Ranch. It contains 3 claims formerly mined by Smith & Attlebury. Reynolds was preparing in October, 1925; to put in a new flume to bring water from McCade Creek, preparatory to resuming hydraulic mining.

Shadows Creek Placer Mine. Near Cecilville. Operated by E. M. Robertson, Albert Brown and D. O. George as an hydraulic mine.

Shumway Mine (formerly Bonaly Mine). Owners, Forks of Salmon River Mining Co. B. M. Newcomb, president and A. C. Aiken, secretary, Flatiron Building, San Francisco. It contains 22 claims, about 220 acres in all, along the North Fork of Salmon River beginning a mile east of Forks of Salmon and extending upstream for about four miles. Yreka and Gazelle, the nearest railroad stations, are 70 miles northeast, by road. The elevation is about 1200 feet.

The deposits consist of bench, back channel and river bar gravel, 10 to 60 feet deep, lying on schist bedrock, and free washing. Parts of the property have been worked intermittently since 1855. It was taken over by the present company in 1916 and they began work in the spring of 1917, and operated until December, 1920. The property was then leased to E. T. Aiken, who worked it until April, 1921. It has been idle since. The reported production from 1908 to 1921 was

\$250,000, but part of the ground handled by the company was old ground and is believed to have made only a nominal return. During the period of this company's activity, the operation was one of the largest of this kind in the state, it having been said that a maximum capacity of 30,000 cubic yards a month was reached in 1919.

Hydraulic mining equipment includes 5000 feet of iron pipe from 11 inches to 60 inches in diameter; 8 giants, a water power hoist and derrick with a capacity of 7 tons, and a blacksmith shop, electric light plant and buildings. A fine water right on the north fork of the river supplied ample water for three No. 5 giants (6-inch nozzles)



Shumway (Bonaly) Hydraulic Mine, on a back channel of Salmon River, with a high rim separating it from the present stream.

under 235 feet fall. Hydraulic mining could be carried on nearly the entire year, except for a period of freezing weather for about six weeks in December and January. Large accumulations of coarser tailing have been stacked on the claims with giants, as there is lack of dump room.

Siskiyou Mines Company. In sections 2, 1, 6, 7, 5, 12 and 18, Ts. 16 and 17 N., Rs. 7 and 8 E., H. M., on Klamath River adjacent to Happy Camp. The original area was 1500 acres of which 640 are patented. This property was one of the three largest hydraulic mines in the county up to the time of high costs following the war. Geologically it is similar to the Davis Mine and was a consolidation of a number of old claims that had been worked in part years before, and a large area of unworked ground consisting of low river bar and high bench gravel.

The bank was from 10 feet deep on the lower bars to 60 feet deep on the higher benches. The gravel was in part loose and in places cemented and lay on bluish schist bedrock. Water under 250 feet fall was taken from Thompson Creek through three miles of 3' by 4' ditch and 10 miles of 36" by 44" flume. Hydraulic mining equipment included three No. 2 giants, two No. 1 giants, 1500 feet of 15-inch pipe, 2500 feet of 11-inch pipe and 480 feet of sluices 3' by 3'. Tailings were dumped into Klamath River.

The company operated the mine steadily until about 1919. At the time of shutting down, the superintendent stated that the gravel was averaging about 10 cents a cubic yard and that this was just about the cost of operation at that time. Since then, lesses have worked the

mine on a small scale.

Siskiyou River Bend. In Oak Bar district, on Klamath River. Since our last county report, this property has been worked out by A. C. Aiken, using an hydraulic elevator.

Six-Mile Creek Placer. Owner, A. E. Westover, Callahan or 480 Pine Street, San Francisco. This contains 40 acres at the junction of Six-Mile Creek and East Fork of Salmon River. 18 miles from Callahan via the Cecilville trail. It adjoins the old Root & Salsberg placer. It is reported to be high ground about 300 feet above the east fork and believed to run parallel to it for about 1500 feet, though this is not certain on account of obscuring slides from the adjacent hill. Where exposed it is stated to be 200 feet wide and 14 feet deep. About two miles of ditch would be needed to supply water for hydraulicking. Equipment includes blacksmith shop, three giants, 800 feet of 11-inch and 15-inch pipe and one-fourth mile of flume, all on the adjoining ground belonging to the same owner, and there is also a cabin. The water of Six-Mile Creek is available for hydraulicking under good head. Westover stated in 1924 that a test of 200 cubic yards proved very encouraging, and during the summer of 1925 he began work on the property.

Snowball Placer. Owners, Barton & Shearer. Address H. J. Barton, Yreka. Leased to Tieke & Scanlon, Oak Bar. This property is four miles west of Horse Creek on Klamath River. It is a low back channel of Klamath River and was partly worked by Chinese. The present lessees have been sinking an incline, and reached bedrock in the autumn of 1925.

S. R. Crary Mine. Owner, S. R. Crary, Walker P. O. This property contains 80 acres, including both quartz and placer ground. Several hundred feet of drifting has been done on a quartz vein, and some placer mining has also been done, using water from McKinney Creek, but the water supply is small.

Stenshaw Mine. Owner, Samuel Stenshaw, Blue Nose P. O. Contains 98 acres, unpatented, in Secs. 28 and 29, T. 13 N., R. 6 E., H. M., on Klamath River 12 miles north of Somes Bar.

The property contains three benches of gravel, averaging about 10 feet in depth and with as much as 40 feet of overburden. Like many other gravel bench and bar properties in this section, this place has been partly used for farming, and hydraulic mining has been carried on for a few months in winter when water conditions were favorable. It is equipped with one giant and about 1500 feet of pipe. Water is taken from Stenshaw Creek.

Squaw Gulch Placer. It is four miles northwest of Callahan and has been a small producer in the past, both as a drift and hydraulic mine, but has not been actively worked of late. It is on Sugar Creek at an elevation of 3420 feet.

Bibl: Cal. State Min. Bur. R. XIII, p. 427; XIV, p. 857.

Sugar Hill Mine. This mine is a mile southeast of South Fork of Scott River and  $5\frac{1}{2}$  miles by road and trail southwest of Callahan. It is on the same kind of decomposed dike as has been mined at the nearby Fippen & Hayden property. Gold occurs in quartz seams and stringers in the rusty, decomposed dike material, and for many years this was worked with a small hydraulic rig, passing from one ownership to another with a small production of gold. Early in 1924, Niekerson, then the owner, leased it with option to purchase to Wolfskill & Lidstone, who started work drifting along a vein of white quartz up to four feet wide which occurs in the dike and which has yielded small pockets of free gold. A crew of 10 men were employed for a while, but in October, 1925, it was reported that work had been suspended some time ago.

Ten Eyck Placer Mines, Inc. Main office, 504½ D Street, Marysville, California. W. T. Tyler, secretary, 715 Bryant Street, Palo Alto. Property contains 80 acres in Sec. 28, T. 12 N., R. 6 E., on the west

side of Klamath River, at the mouth of Ten Eyck Creek.

The deposit consists of three bench deposits of gold-bearing gravel, the lowest of which is 50 feet above high water level of the Klamath and has a slaty schist bedrock. The second bench is 300 feet higher and has serpentine bedrock and finer gravel. The higher bench was worked in 1909 but work was suspended there because tailings from it would cover the unworked part of lower bench. Later work was on the lowest bench. A No. 3 giant under 225-foot head has been used, water coming through a ditch and 1000 feet of 11-inch pipe. There is considerable overburden of broken country rock but it is not as heavy or bothersome here as at some other properties along the river, on account of the creek having graded down the canyon slope. The bank is 40 to 80 feet in depth, 300 to 400 feet wide, and gravel is loose, with some large slabs of serpentine and slate.

While earlier work was reported profitable, the present company is

now (Oct., 1925) levying a stock assessment.

The mine has produced some platinum group metals (see under Platinum). West of the gravel deposit, serpentine occurs with diorite or other basic dikes. A number of small gold pockets have been found in this area.

Thomas Mine. Owners, Thomas Brothers, Blue Nose P. O. It is in Cottage Grove district, Sec. 29, T. 14 N., R. 6 E., three miles north

of Blue Nose on the Klamath River.

Two claims, in loose bench gravel about ten feet deep with four feet of overburden, have been mined in late years. Two benches, one near the river and one higher, have been opened. Inadequate water supply permits only about four months working season. The work has been done by hydraulicking, using two small giants and 9-inch pipe.

Two and a Half Mine (Walker Placer). On Grouse Creek, six miles east of Callahan in Sec. 20, T. 40 N., R. 7 W., M. D. M. It was

formerly a good producer, with a reported output of \$200,000 from hydraulic operations, but has been idle in late years.

Bibl: Cal. State Min. Bur. R. XIV, p. 857.

Welch & Bradley Placer (Progressive Placer Mine). Owners, C. W. Welch and S. D. Bradley. Placer ground on Beaver Creek. Has been active in recent years.

Whistle Bar Placer Mine. Owners, Ed Kearns, Sawyers Bar, and Robert Kearns, San Jose. On North Fork of Salmon River a mile and a half west of Sawyers Bar. This was operated many years ago as a river claim. It contains, in addition to the portion of river bed, a back channel, said to be 25 feet below the present river and a section of high bench gravel 75 feet above the river on the south bank, with a width of 80 feet, length of 1800 feet, and depth of 20 feet.

The owners have in recent years sunk an incline and have done some



Woodfill & Barry Hydraulic Mine, on Eddys Gulch, near Sawyers Bar.

drifting in the deep channel, with a small production. In the autumn of 1925 a flume was being built from the end of the old Bigelow ditch to bring a supply of water from Jessops Gulch, a distance of about two miles, in order to hydraulic the high bench deposit. There is estimated to be 600 inches of water available under 200 feet pressure. The gravel is said to prospect well.

Willard Placer (see Hoosier Hill).

William Burns Placer (see Joubert Placer Mines).

Woodfill and Barry Placer Mine (Gold Bank and John Frank Mines). Owners, J. Woodfill and C. J. Barry, Sawyers Bar. Contains 80 acres extending upstream on Eddys Gulch for nearly a mile from its mouth, and one-half mile to  $1\frac{1}{2}$  miles from Sawyers Bar. Elevation

2000 feet to 2300 feet. The claims have been worked in a small way for many years by others, including Ramsey and Frazier, but were relocated in 1924 by the present owners.

The deposit is composed mostly of angular unassorted gulch filling, somewhat waterwashed on the rims. The ground worked the past season varied from 14 feet deep in the channel to 35 feet deep on west rim with a width of 40 feet, and overburden increases to the west. This is a segment of an old back channel of Eddys Gulch, 40 feet above the present stream, and on account of the overburden of soil on the banks going upstream, it is impossible to say how much of such ground remains. As shown in the photograph, the ground is excessively rocky, but paid a good profit to the owners, who are said to have realized a gross yield of \$8,600 from the season's run of about 20,000 cubic yards with one man employed besides themselves. The work is some distance from the river, as the gulch bed has been extensively worked previously. Besides this high ground, the owners claim they have a length of possibly 800 feet of unworked deep ground under the gulch, where a prospect incline 19 feet deep gave encouragement.

In a good water season about 500 inches of water from Eddys Gulch is available for piping for six to eight months. There are 2400 feet of new flume, 600 feet of pipe, one 3½-inch giant, a derrick operated by water power, and several hundred feet of sluices 12 by 18 inches, and blacksmith shop on the claim.

# GOLD DREDGING.

Several gold dredgers have been operated in the county, but no dredging is going on at present.

El Oro No. 3 was operated a number of years on Greenhorn Creek which drains an area of gold-bearing schists near Yreka, emptying into Yreka Creek, Shasta River and Klamath River. The ground was finished in 1920. This dredger was El Oro No. 1, rebuilt. It was 202 feet long, with 40-foot beam and carried 89 buckets of 6 and 64 cubic feet capacity. It was rigged with a 16-foot extension on the digging ladder, and could dig to a depth of 38 feet below the water level. Its capacity was 75,000 to 80,000 cubic yards a month, and it was operated by electric power. This dredger was equipped with an 18-h.p. boiler to supply steam for use in keeping the stacker belt free from frost, as the winters are cold. In summer the supply of water was short.

The gravel had an average depth of 18 feet and a width up to one-fourth mile and the bedrock was slate, schist and porphyry. gold was fairly coarse and was caught on the first four tables. gold yield from this ground was reported satisfactory.

Bibl: Cal. State Min. Bur. Bull 85, pp. 36-37.

Northern California Dredge Company had a small suction dredger on their property in Sec. 36, T. 46 N., R. 11 W., one-half mile west of Hamburg Bar, but this was unsuccessful, and work stopped in 1911.

Bibl: Cal. State Min. Bur. Bull. 57.

Oak Bar Dredge was operated a short time on Klamath River near Oak Bar (Walker P. O.). This worked only a small area, and the results are not known, though believed to have been unprofitable.

Poker Flat Dredger was operated in the same section as the last named, one-half to one mile below Callahan on the South Fork of Scott River, for about two years. This was a Risdon dredger with buckets of  $2\frac{1}{2}$  cubic feet capacity, and cost about \$45,000. It recovered about \$10,000, and was said to have been about worn out in the two years.

Porters Bar Dredging Company drilled 175 acres of bottom land on the South Fork of Scott River in Sec. 7 and  $S_2^1$  of Sec. 6, T. 40 N., R. 8 W., a mile and a half below Callahan. The holes varied in depth from 12 to 42 feet, most of them being from 27 to 35 feet deep and drill prospects were good, but values averaged low, although a few thousand cubic yards were of good grade. A width of 300 to 450 feet was drilled but only 210 feet in width was dredged to an average depth of 30 feet. The project was soon abandoned. Bedrock is hard in this section, gravel is quite rocky, and is said to be cemented in spots.

There is a length of  $2\frac{1}{2}$  miles along this stream near Callahan, where there is a total of perhaps 350 acres of bottom land composed of such auriferous gravel. This land is now owned by R. V. Hayden, F. D. and R. C. Sullivan, of Callahan. A total of 2000 inches of water is claimed to be available under 180 feet head with two miles

of ditch. The dump room is small, however.

Siskiyou Dredging Company operated successfully for many years on an area of 165 acres on McAdams Creek in Deadwood district, Secs. 14, 6 and 25, Ts. 44 and 43 N., Rs. 8 and 9 W. This ground included the Oak Grove, Diggles, Mathewson and Shaw drift mines. The gravel was 30 to 60 feet deep, loose and reported easy to work. The dredger was of Bucyrus type, with  $5\frac{1}{2}$  cubic feet buckets and equipped to dig 50 feet below water level. It was operated by electric power, and had a capacity of 2000 cubic yards a day. It operated between 1910 and 1920.

Bibl: Cal. State Min. Bur. Bull. 57, p. 223. Report XIV, pp. 864–865.

### GRANITE.

Good quality granite occurs on Craggy Mountain in T. 41 N., R. 8 W., and in Sec. 1, T. 41 N., R. 9 W., also in T. 40 N., Rs. 8 and 9 W. This has been used locally in a small way for building blocks and monuments. The deposits are all a long distance from railroad.

Bibl: Cal. State Min. Bur. Bull. 38, p. 54.

### IRON.

Float iron ore is mentioned as occurring in Sec. 10, T. 46 N., R. 10 W.

Bibl: Cal. State Min. Bur. Bull. 38, p. 304.

#### LEAD.

On the Fippen & Hayden Placer (see under Gold Placer Mines), in the Callahan district, an adit of unknown length was run, many years

ago, to prospect for lead. A small amount of good galena ore was brought out of this adit and dumped. In 1924, M. E. Gardner sluiced off the soil overburden and exposed the edge of the vein in place above the old adit. The exposed section is about 30 feet long and the width of vein is from a few inches to one foot. It consists of barite, carrying lumps and stringers of galena. Assays of the ore indicate a high lead content, sufficient to make the best samples a good shipping ore, and with a fair content of silver. Ore could be concentrated by jigging. Gazelle, the nearest railroad point, is 27 miles distant by road. This prospect is idle.

Other prospects of lead ore have been reported in the region eight to ten miles east of Callahan near the Gazelle road, but so far as could be learned, the float found there had not yet been traced to the vein, although some prospecting was going on in the late summer of

1925.

## LIMESTONE AND MARBLE

There are large deposits of limestone and marble in the county, but for the most part these deposits are remote from present railroads. The deposits nearest to transportation are in the area of Devonian rocks just west of Gazelle. For local use in Scott Valley, deposits near Etna Mills, Greenview and Callahan have been worked in a small way. An area of Devonian rocks, containing coral limestone, extends from near Callahan northward for nearly 20 miles.

Large deposits of marble occur in a belt running west of Etna Mills along the east slope of the Salmon Mountains, northwest through the Marble Mountains, the Grider Mountains and past Thompson Creek. Should the demand ever arise, and means of transportation be provided, Siskiyou County could supply nearly any demand for limestone. Under present conditions, however, the deposits, many of which are hardly prospected, could not compete with others in the state that are nearer railroads.

Jason Chastain of Gazelle has been doing some work recently on promising limestone deposits four miles west of Gazelle. This is in one of the areas of Devonian rocks mentioned.

Wurst & Majors of Etna Mills have operated a small mill from time to time in recent years on a deposit in McConaughy gulch, near Etna Mills. They have crushed limestone for local farm use, as a soil corrective and fertilizer.

Deposits that have been mentioned in past reports are listed below:

Name of deposit and location

Remarks

Burton, Sec. 17, T. 43 N., R. 9 W. 4 mi. NE. of Greenview____limestone Farrington, Sec. 24, T. 40 N., R. 9 W. 2½ mi. SW. of Callahan-limestone Marble Mountain, Secs. 16, 19, 20, 21, T. 43 N., R. 10 W.____marble Barton & Barham, Sec. 18, T. 46 N., R. 9 W. in Oak Bar district. Luce, two miles N. of Fort Jones in Deadwood district_____good marble McDaniels, Sec. 6, T. 41 N., R. 9 W._____white marble ----white marble Parker, Sec. 32, T. 42 N., R. 9 W. near Etna Mills____pink, white marble Thompson Creek, Sec. 8, T. 17 N., R. 8 E., H. M., 82 mi. NE. of

Bibl: Cal. State Min. Bur. Bull. 38; R. XIII, p. 632; R. XIV, pp. 865, 867.

#### MINERAL WATER.

There are in the county a number of mineral springs, several of which have been known for years as summer resorts. Considerable water has also been shipped from Shasta Springs. Among the principal resorts are Shasta Springs, Warmcastle Soda Springs, Klamath Hot Springs, Garretson Springs, Neys Springs and Upper Soda Spring. These, except Klamath Hot Springs, are cold carbonated springs. All of these springs have been described in the past publications of the Bureau and at a later date (1915) in U. S. Geological Survey Water Supply Paper 338, which covers the subject in great detail, so that there is no need of repeating this information here. Waring in the last mentioned report lists 15 groups of carbonated springs in the county. They may be grouped in three localities; those near Beaver Creek, in the northeastern part of the county, those in the western part of the lava-covered area in the vicinity of Ager, and a third and most important group because of their accessibility, near Sacramento River in the southern part of the county.

Bibl: Cal. State Min. Bur. R. XIII, p. 520; XI pp. 449, 452; U. S. G. S.; W. S. P. 338; Winslow Anderson, Mineral Springs of California.

# ORNAMENTAL AND GEM STONES.

Californite, a massive green vesuvianite, was first found on Indian Creek, north of Happy Camp. It is a hard, massive mineral with a vitreous luster and varies in color from nearly white to olive green. It has been mistaken for jade here and in other localities. The mineral occurs on claims belonging to the Reeves Davis Estate and Henry Howard, on the South Fork of Indian Creek, 10½ miles north of Happy Camp. It also is found as float, in large and small boulders, on placer claims belonging to Scott Greening, on O'Meara Creek, a tributary of Indian Creek, which enters it at the Classic Hill Mine, 12 miles north of Happy Camp, and pieces of float have also been found elsewhere along the course of Indian Creek and in the mountains on the west side of the creek. Nothing has been done to develop it.

Bibl: Cal. State Min. Bur. Bull. 37, pp. 93, 94; R. XIV, p. 869.

Onyx occurs 200 yards downstream from Shasta Springs near Sacramento River. The deposit has been known as the *Griffin Onyx Marble Quarry* and contains a vein about five inches wide. Small articles such as paper weights have been made from it. Idle.

Fire opal is mentioned by Eakle¹ as occurring near Dunsmuir.

C. B. Kay of Ager has lately been doing some work on a deposit of fossiliferous sandstone which occurs on the Henry Hagedorn and Sidney Richardson Ranches five miles south of Ager in the NE¹/₄ of Sec. 26, T. 46 N., R. 6 W. There are several beds of the stone, ranging from three inches to one foot wide and dipping east about 23°. Some of these beds are so thickly matted with shell remains as to give the polished stone a very pleasing and unique appearance as the sand-

¹ Eakle, A. S., Minerals of California; Cal. State Min. Bur. Bull. 91, 1923.

stone is nearly black and in contrast with the white shells. The stone being fine-grained is hard and compact enough to take a polish, and might find a market for small articles. It contains a high percentage of cementing calcite in addition to that in the fossil shells.

## PLATINUM GROUP METALS.

Osmiridium and platinum occur with gold in the gravel deposits along Klamath River and Salmon River. The subject of the occurrence of these metals was covered by the writer in considerable detail in the Bureau's Bulletin 85. These metals occur in very small proportion to the gold content of the gravel, and the output from the county

is negligible.

Field work for the above report showed that while platinum group metals occur in the gravel of the South Fork of Salmon River in appreciable amount from Matthews Creek downstream, at least as far as Forks of Salmon, there has been practically no platinum or osmiridium found in the placer mines of the North Fork, although these have yielded several times as much in gold as the placers of the South Fork. The presence of platinum group metals on the South Fork side, and their absence from the other fork, is attributed by the writer to the presence of considerable outcropping serpentine and peridotite in the drainage basin of the south fork, while these rocks are found only in a few very small areas on the north fork side. The platinum and osmiridium formerly recovered at the Nigger Hill and Michigan-Salmon hydraulic mines probably came from nearby serpentine areas. Nuggets up to \(\frac{1}{2}\) ounce in weight were found. An analysis of a shipment from the latter mine showed 97.05% osmiridium and 2.95% platinum. This comes nearer to being pure osmiridium than any other known sample in the state. While platinum usually occurs in the placers as thin, smoothly hammered flakes, similar in size and shape to fine placer gold, on account of its softness, osmiridium or iridosmine usually are found in ragged, angular pieces because of the great hardness of these native alloys. The latter may be dull, rusty, or coated, and might easily be mistaken for lead were it not for the fact that none of the metals of this group can be melted in an open fire as can lead, and the above named alloys are much harder than lead and as a rule so feebly magnetic (if at all so) that they are easily distinguished from iron or its compounds.

One ounce of platinum group metals to \$3,000 in gold is about the usual proportion in this state where the two occur together. The proportion of platinum is a little higher than this on the South Fork of Salmon, and lower on the Klamath. None of the other placers of the county are known to have produced platinum, and none was recovered from the dredging operations on McAdams and Greenhorn Creeks.

It is believed that the platinum metals in place occur only in narrow stringers or seams in serpentine and in the rocks from which serpentine is derived, such as peridotite, dunite and gabbro. Only one report has come to the writer's attention of platinum in place in this county. This was in a quartz stringer prospected by Morgan Bros. of Gottville, while hunting pockets on Empire Creek. They state that the report was made by a Denver assayer. The quartz prospect gave out entirely after being followed a few feet.

### PUMICE.

Siskiyou County is one of two counties in the state that have produced pumice in recent years, the other being Imperial. Pumice is a cellular, glassy lava, commonly having the composition of rhyolite, but with a great proportion of voids. Deposits of pumice near Bartle in this county were under investigation by the Southern Pacific Company as early as 1909, when tests were made by J. N. O'Hara for Wm. Hood, chief engineer of the company, to determine whether or not the pumice was suitable for use in concrete where a heat-resisting and nonconducting material was desired. Although it was found that the pumice did not give satisfactory results as coarse aggregate in concrete, it was learned that concrete containing pumice as fine aggregate and also in place of sand, had remarkable heat-resisting and insulating properties. The mix contained one part Portland cement, two parts pumice sand (under one-fourth inch) and three parts pumice gravel (one-fourth inch to one inch). Briquettes of this mix, aged 30 days, had a compressive strength of 301 pounds per square inch in air and 283 pounds per square inch in water, and weighed only 57½ pounds per cubic foot. A 6-inch cube of this concrete was subjected to the continuous heat of a Bunsen burner for two hours and was then immersed in water. No fire or smoke passed through, and there was no disintegration, warping or bulging. A similar sized cube of standard materials (one part of cement, two of sand and three of gravel) when subjected to the same test, is said to have disintegrated to a depth of 13 inches, cracked in water and was too hot to touch on the side away from the flame. No practical use is known to have been made of the pumice as a result of the tests. Between 1918 and 1921, when the importation of foreign pumice was prevented by shipping conditions, considerable pumice was shipped from the vicinity of Bartle. It was used in abrasives, for fire-brick and as an insulating filler in the walls of refrigerators and cold storage plants.

### QUICKSILVER.

Cowgill Quicksilver Mine. Owner, Mrs. A. M. Cowgill, P. O. Box 96, Yreka. In Sec. 34, T. 48 N., R. 9 W., on the headwaters of the West Fork of Beaver Creek, 10 miles in an air line from Gottville but farther by road.

According to Bradley ¹ there was some work done here years ago by Siskiyou Quicksilver Mining Company, who built a 10-ton furnace and are said to have produced a few flasks of mercury. During the wartime boom in quicksilver, Mercury Company of America did some prospecting on the surface, and put up a 12-pipe retort. Cinnabar was found in the decomposed surface soil to a depth of 60 feet. This company did little work.

Lately some work has been done by the owner and the property is for

Great Northern Quicksilver Mine, Inc. (Formerly Morgan Brothers Mine.) Office 414 Second Street, Marysville. Frank Fisher, president, Meridian P. O. Frank and David Morgan, discoverers, own 50% of

¹ Bradley, W. W., Quicksilver Resources of California: Cal. State Min. Bur. Bull. 78, p. 169, 1918.

stock. Holdings comprise six unpatented claims and 60 acres of patented land in Secs. 13, 14, 24, T. 47 N., R. 8 W., four miles by road from Gottville on East Fork of Empire Creek, and 19 miles by road west of Hornbrook. Elevation 3400 feet.

Morgan Brothers first discovered quicksilver in this vicinity in 1905, and did the first work on these claims in 1915. The property was equipped with retorts during the war-time quicksilver boom, and produced 27 flasks of quicksilver in 1919. Three flasks were pro-

duced in the course of experimental work in 1925.

Quicksilver occurs both as free metal and as cinnabar in several well-defined fissure veins carrying gouges. The main or Leroy adit runs N. 70° W. 200 feet and the veins are exposed in a crosscut northward from it 100 feet. What appears to be the main vein here strikes N. 37° E. and dips nearly vertically. It has a width of nine feet and makes a good showing of cinnabar. A cross vein strikes N. 85° E. and dips 32½° N. Another vein nine feet wide was cut 32 feet west. This strikes N. 15° to 20° E. and dips 67° NW. It shows considerable native mercury and cinnabar. A raise 135 feet long is said to show ore above this level. The next level above, called Ore bin level, is 150 feet long. The vein here strikes N. 43° E. and dips 42° NW. About 12 feet in width shows mercury and cinnabar plainly, but a width of 30 feet is claimed to be ore bearing. The vein is also exposed by other upper workings. The No. 1 or uppermost level is about 130 feet vertically above Leroy level. The ore is of unknown width here and shows cinnabar in decomposed rock.

The vein is composed of a breceia of hard, fine grained, black rock, possibly a hornfels recemented by calcite. So far as can be determined by the examination of large samples without the aid of a microscope, the cinnabar occurs entirely in the calcite and the free mercury in numerous small vugs left partly unfilled. The manner of deposition is indicated by the growth of cinnabar crystals from both walls of partly filled cavities lined with calcite. The black fragments carry some pyrite. The mercury content of the ore is said to run from one-half per cent to 1½ per cent. Oxidized rock from the upper workings showing little or no cinnabar pans well. The outcrop can not be traced except by panning and surface relations are obscure, but other showings of ore are claimed 600 feet west, on the other fork of the creek. On the hanging wall side, 300 feet distant from the workings there is a prominent outcrop of limestone 200 feet wide,

striking northeast and said to be traceable a mile.

The property is equipped with 12 Johnson McKay retorts, two D retorts, and one Steele retort, the latter an experimental installation; also one 75-h.p. Holt gas engine, one 6-h.p. gas engine and an air compressor, all at Leroy adit. The camp, consisting of several good small buildings, is about one-half mile from the workings.

Minnehaha Prospect. Owners, H. J. Barton et al., of Yreka. It is in Sec. 15, T. 46 N., R. 10 W., at Horse Creek bridge on Klamath River, 36 miles west of Hornbrook, and contains 20 acres, patented. Prospecting has been done in the superficial, decomposed part of the deposit and nothing is known about it in depth, although it was first found in 1878. A small amount of cinnabar, recovered by washing

the soil through a sluice-box, was sold years ago to Chinese. There has been no recent work done.

Bibl: Cal. State Min. Bur. R. XIII, p. 602; XIV, p. 870; Bull. 27, p. 196; Bull. 78, p. 169.

#### SANDSTONE.

Sandstone beds form the rim of Shasta Valley, outcrop east of Yreka and are found at several places from Snowdon to the Oregon line (see under Geology). A number of years ago, before cement came into such general use, sandstone was quarried here as well as in other counties of the state. Three quarries were described in our past reports.

Antone or Weeks Quarry is two miles northeast of Yreka. The sandstone was quarried in layers from six inches to eight feet thick and has been used considerably for building in Yreka.

Fiock Bros. Quarry is in Sec. 13, T. 45 N., R. 7 W., near Yreka. The stone is coarse grained, even textured and tawny in color.

Southern Pacific Company has quarried considerable sandstone in Sec. 29, T. 47 N., R. 6 W., near Hornbrook. This stone has been used for railroad culverts and for some buildings in Hornbrook.

### SOAPSTONE.

Soapstone and talc might reasonably be expected to occur at many places in the county, where serpentine is found. For the location of serpentine outcrops, the reader should refer to the sections on Asbestos and Chromite, herein. To date, no commercial development of soapstone has taken place in Siskiyou County. For the most part, the deposits noted are a considerable distance from the railroad. Such deposits, of good size and said to be of satisfactory quality, are found in the northeast part of T. 45 N., R. 11 W., southeast of Hamburg Bar; also near the head of Wooley Creek, and better grades are said to have been found in a deposit on top of the divide between Beaver and Bumblebee Creeks and in a small deposit in Sec. 32, T. 42 N., R. 9 W., near Etna Mills. The business of soapstone and talc production and marketing is highly competitive, and the market prices of lower grade and 'off color' soapstone and talc are so low that only deposits near the railroad can be worked at a profit. There is a scarcity of high-grade, white-grinding talc, however, in the northern end of the state, such ore at present coming from the southern counties, while 'off color' soapstone, used for roofing where the shade is not important, is produced near the railroad in El Dorado County.

### STONE INDUSTRY.

Since 1916, Siskiyou County has produced considerable crushed rock and gravel for road construction. The stream gravels near Yreka, as for example the dredged portions of Greenhorn Creek, and some areas of volcanic rock near enough the railroad are the most convenient sources of supply. There has been a considerable length of

both state highway and rock-surfaced county roads built in the county in recent years, and local stone has been utilized.

Kaiser Paving Company's Black Butte Quarry is four miles north of Sisson on the Pacific highway. This plant has been operated intermittently, and has produced quite a large tonnage of crushed rock. The material is a hard dark volcanic rock, forming a prominent cone-shaped mountain just east of the state highway. The quarry is served by a spur track from the main line.

Steele Quarry is three-fourths of a mile southeast of Yreka. It has produced crushed rock for local use.

#### BIBLIOGRAPHY.

Publications covering the geology and mineral resources of Siskiyou County. California State Mining Bureau.

Reports of the State Mineralogist:

II, pp. 47, 184–189. IV, pp. 73, 99, 115, 137, 310.

V, pp. 67, 112.

VI, part 1, pp. 93, 96, 101, 118; part 2, pp. 63, 187. VIII, pp. 14, 24, 581-631. IX, pp. 31, 262, 318, 319.

X, pp. 655-658.

XI, pp. 420-452.

XII, pp. 61, 275-294, 346, 370, 459-471.

XIII, pp. 34, 55, 64, 386-435, 520, 521, 632.

XIV, pp. 810–872. XVII, pp. 529–536.

XVIII, pp. 6, 96, 139, 206, 256, 581, 700, 297, 354, 495, 600, 733.

XIX, pp. 11, 58, 93, 138.

XX, pp. 179-182.

Bulletins 27, 37, 38, 50, 57, 67, 70, 71, 72, 74, 76, 78, 83, 85, 86, 87, 88, 89, 90, 91, 92, 93 94.

Register of Mines of Siskiyou County, with map.

Note-All reports prior to Fourteenth, except Eleventh, are out of stock, as are also many of the bulletins and the Register of Mines. Copies may be consulted at Bureau offices.

Publications of United States Geological Survey.

Mineral Resources of the United States from 1903 to date, various pages.

Separates of this publication, covering particular minerals, may be had.

Beginning with the present year, this publication will be issued by the U.S. Dept. of Commerce, Bureau of Mines, Washington, D. C.

Fourteenth Report, Part II, pp. 404-434.

Bulletins 196, 507.

Topographic Maps for Preston Peak, Sawyers Bar, Seiad and Shasta quadrangles.

# SAN FRANCISCO FIELD DIVISION.

C. McK. LAIZURE, Mining Engineer.

# SAN LUIS OBISPO COUNTY.

# Introduction.

The history of San Luis Obispo County is linked with that of the early Spanish settlement and occupation of California. In 1772 the Mission San Luis Obispo de Tolosa was founded and the village which grew up around it became later the city of San Luis Obispo, county seat of the county, which also took the same name.

The county was organized in 1850 shortly after California was admitted to the Union, it being one of the original twenty-seven formed at that time. Between 1851 and 1885 its north, east and south boundaries were moved several times but with little change in its area

or general outline.

Probably ninety per cent of its acreage formerly was included in Spanish grants, whose dimensions were expressed in leagues, and many ranchos containing from ten to fifty thousand acres long remained intact. These large holdings are gradually being cut up, however, and much of the valley land is now intensively cultivated. Dairying and stock raising are important pursuits. But little public land remains and, with the exception of claims already located, mining of necessity must consist mainly in the development and production of minerals found on these privately-owned lands, either through purchase or lease. Climatic conditions are excellent and mining can be carried on the year round, although in the more remote districts the condition of the roads in the rainy season makes hauling impractical.

## Geography.

San Luis Obispo County borders on the Pacific Ocean and occupies a position midway between San Francisco and Los Angeles. It is bounded on the North by Monterey County, on the east by Kern and on the South by Santa Barbara. It contains 3334 square miles and has a population of 21,893 (1920 census). The coast line of the Southern Pacific railroad passes through the county from north to south. The railroad follows Salinas River Valley through Paso Robles to a point near Santa Margarita, thence it crosses the Santa Lucia Range via Cuesta Pass, reaching San Luis Obispo at the foot of the grade, and the ocean near Pismo. It continues south along the ocean shore giving through transportation. The Pacific Coast Railroad (narrow gauge) connects Port San Luis with San Luis Obispo and continues to Santa Maria and other points in Santa Barbara County. The paved Coast highway closely parallels the Southern Pacific railroad through the county.

From Santa Margarita fair dirt roads extend to the eastern part of the county, but McKittrick in Kern County is a nearer railroad point to this section. Steamer service is available at Port San Luis. This harbor is the terminous of pipe lines from the San Joaquin Valley oil

fields and is an important loading point for oil tankers.

## Topography.

The Coast Range mountain system traverses the county from northwest to southeast. Within the county this mountain block consists 7—42102

of three main ranges. The Santa Lucia Mountains, the central and most prominent range divide the county into two unequal provinces, the larger lying north and east of this barrier and the smaller south and west of it. The southwestern area is again divided into Los Osos, San Luis, Arroyo Grande and Santa Maria valleys by lesser ridges, of which the San Luis Range, which terminates on the coast at Point Buchon and runs a little south of east until it unites with the Santa Lucia, is the most elevated. Northeast of the main Santa Lucia Range lies the upper Salinas River basin and numerous smaller valleys. The broad San Jose Range, including the La Panza Mountains and numerous spurs, occupies the area east of Salinas River. Near the source of the river this range unites with the Santa Lucia. Between these mountains and the Tremblor Range in the southeast, which roughly forms the eastern boundary of the county, is the peculiar fault valley known as Carrizo Plain. This valley has no outlet, its scanty run-off draining to the center where Soda Lake has formed.

# Geology.

The geology of that portion of the county from the southern boundary to latitude 35° 30′ N. and from the coast to longitude 120° 30′ W. has been described and mapped in detail by H. W. Fairbanks.¹ A discussion of the geology of the county with relation to petroleum resources will be found in Bulletins No. 69 and No. 89 of the State Mining Bureau. A folio of geologic maps accompanies Bulletin No. 69.

As indicated on the Bureau's geological map of the state, the Santa Lucia Range from San Luis Obispo northwestward to the northern boundary line is made up of Franciscan rocks, including slates, cherts, limestones, and sandstones, with much serpentine and many dikes and intrusions of deep-seated igneous rocks. On the flanks of the range are narrow belts of Cretaceous sandstones and shales. Southeast of San Luis Obispo the formations are mainly Tertiary marine sandstones and diatomaceous shales. Unconsolidated sands, gravels, and clays extend from Pismo to Santa Maria River and well up the valley of the Santa Maria. East of Santa Margarita there is a large area in which granite predominates. The balance of the county lying east and north of the Santa Lucia Range consists almost entirely of sedimentary rocks of Tertiary age, shales, sandstones, tuffs, and gravels with an area of Quaternary sediments comprising Carrizo Plain.

## MINERAL RESOURCES.

A varied production of mineral products over a period of more than 75 years, whose value has run into the millions of dollars, has established this county as an important though not spectacular mining district. Both metallic ores and nonmetallic substances are widely distributed throughout the county, but their full extent and ultimate value is unknown due to lack of development. The county is known mainly for its production of quicksilver and chromite.

Gold in limited amount has been produced since an early date. Copper minerals are not uncommon throughout the Santa Lucia Range, but important deposits of commercial ores have not been developed. Antimony and manganese occur, and there has been some production

¹ Fairbanks, H. W., U. S. Geological Survey, San Luis Folio, No. 101.

of the latter. Platinum is a constituent of the black sands of the coast. Recent development has shown the iron ore deposits near San Luis Obispo to be of such extent and quality as to make them a factor to be seriously considered in any investigation regarding the establish-

ment of an iron and steel industry in this state.

In the south and southwest there are extensve deposits of bituminous sandstone, probably the largest in the state. The Arroyo Grande oil field produces some low-gravity petroleum. Hot and cold mineral springs and wells are found in various parts, especially in the vicinity of Paso Robles. Many varieties of stone, suitable for building purposes, are found here, including volcanic tuff, sandstone, granite, and onyx marble. These have been utilized to some extent. Bricks have been manufactured in considerable quantity. There are extensive deposits of diatomaceous earth and volcanic ash. Limestone and dolomite occur in quantity. Soda (salt cake) is produced at Soda Lake. Other non-metallics, whose occurrence have been reported, are gypsum, magnesite, tourmaline and glass sand.

About twelve other mineral species, whose occurrence is of scientific

interest only, have been found in the county.

The last general report on the mining industry is contained in Report XV of the State Mineralogist, 1915–1916. The quicksilver mines are described in detail in Bulletin No. 78, 'Quicksilver Resources of California,' 1918. Bulletin No. 76, 'Manganese and Chromium in California,' 1918, covers deposits in this county, as of that date. A discussion of the petroleum resources and possibilities of this area will be found in Bulletin No. 69, 1914, (out of print) and in Bulletin No. 89, 1921, (out of print).

The writer spent two weeks of September, 1925, in a resurvey of the mineral deposits of the county and gathering data relative to new developments and the present status of the industry. The assistance rendered by mine owners, operators and Chamber of Commerce officials

is gratefully acknowledged.

Some data from earlier reports are included herein, but only brief mention will be made of properties (particularly quicksilver and chrome mines) covered in the special bulletins mentioned above, that are still in print. The petroleum industry is important, but distinct from other branches of mining, and it will be only touched upon.

In 1924 San Luis Obispo County produced eight mineral substances, valued at \$317,779, as compared with an output valued at \$145,249 in 1923. The banner year was during the 'war period,' in 1918, when the

value of the county's mineral output totaled \$858,689.

The following table gives the total recorded output from the earliest year for which figures are available to and including 1924:

#### SAN LUIS OBISPO

	Bitumino	ous rock	Br	rick	Chee	mite		Miners	1 water
Year			DIICK		('hromite		Gold, value	Mineral water	
	Tons	Value	М.	Value	Tons*	Value	value	Gallons	Value
8763									
377		(			()				
78		(			(	(	(	(	
79		1				(	()	(	
80		()	/		217,030	\$184,704	(	(	
81		()			1,790	24,000	(		
82		()					\$5,000		
83		()			5,558	99,200	(		
84		()	/		070		(		
85		()			670	8,880	0.101		
86	26 000	0100 000			980	13,140	9,164 1,740		
87	36,000	\$180,000			600	7,980 2,550	1.740		
88	43,000	215,000	()		300	2,550	3,000	(	
89		()	()		4,300	66,865	6,260		
90		()			687	5,496	8,800		
		[]			74	592	1,785		
92		()					1,097	(	
93		()					600		
94	9,432	32,263			4800	10,500	1,200		
			750	20.750					
95	6,354	17,600	750	\$3,750	4700	6,650	3,000		
96	5,113	11,464			4200	2,000	3,000	7.000	
97	2,291	5,117	020	7.000			2,500	7,800	\$1.9
98	4,788	18,927	830	5,280		[]	1,000	800	4
99	10,818	40,288	650	3,500					
00	3,346	12,905	500	4,000			200		
01	9,472	33,070	650	5,200		[]	300	24,000	6,0
02	1,790	2.327	900	7,650	/	/	2,399	4,500	8
03	3,365	7,572	750	6,000		[]	1,840		
04	2.500			2 200	/		630	4,000	1,0
05	2,533	6,348	400	3,200		()	300		
06	2,533	6,644	300	2,400					
07	2,167	8,128	2,000	16,000			316	4,800	1,0
				1				1	
088	5,077	21,875	1,440	12,900				4,800	1,0
09	2,731	6,369	2,245	19,605				4,000	1,0
								1	
10	1,982	4,016	900	8,000		[]	/	6,000	1,0
11	2,710	5,230	2,000	18,000		[]	()	2,000	1,0
12	807	1,472						2,500	
13	609	1,149	1,750	17,500			124	1,500	
14	579	1,118			6	/		1,000	
15	6	()			6			4,500	
016	6		4,150	45,500	1,855	27,733		2,500	
917	6		6		4,109	92,846		1,500	
18	6				10,443	539,423		6	
)19	8				1,158	26,431			
920					399	10.440			
921					6				
922					6			6	
923					6			6	
924			2,033	35,987					
Totals	6157,497	\$638,882	622.248	\$214,472	651.653	\$1,129,430	6\$54,055	676,200	\$18,

^{*}Copper was weighed in tons of 2,360 pounds and chromite in tons of 2,240 pounds, but here converted to 2,000 pounds.

'The total production of asphaltum up to 1894 was reported as 800 barrels. This production reduced to tons is shown

[&]quot;The total production of asphaltum up to 1894 was reported as 800 barrels. This production reduced to tons is shown under 1894.

Although a great deal of chromic iron ore was mined and marketed during the '70's, there are no records of yearly production. The above figure for 1880 represents the total shipments from San Luis Obispo up to August, 1880.

There are no records of annual mineral production for the period of 1865-1876, but there was a small annual gold production from shallow placers before this, and these placers have no doubt yielded considerable gold never reported. The same observation applies to a number of small quicksilver properties worked in the '70's.

*Concentrates.

*Includes crushed rock, rubble, sand, gravel; also granite and sandstone prior to 1915

*See under 'Unapportioned'.

# COUNTY, 1876-1924.

Petroleum Quicksilver		ksilver	Miscel- laneous	Miscellaneous and unapportioned			
Barrels	Value	Flasks	Value	stone ⁵ , value	Amount	Value	Substance
		6,428 3,310	\$282,832 123,463		*236,000 lbs.	\$7,287	Copper.
		2,151	70,768				
		779	2,358				
					(		A 1. 14 ( 1)
				\$8,772	1220 tons 500 cu. ft.	4,400 20,000	Asphaltum (rock). Cal. onyx.
		20	800	45,520	400 cu. ft.	4,000	Cal. onyx.
		101	3,400	17,407	100 cu. 10.	4,000	Cat. Ony A.
		101	3,939	13,500	238 cu. ft.	1,000	Cal. onyx.
		384	11,660	47,000			
		394	17,700	6,740	16 tons	320	Asphaltum (rock).
		515 840	23,886 41,513	44,835	2,000 tons	30,000	Asphaltum (rock).
		3,312	147,215		4,000 tons	40,000	Asphaltum (rock).
		4,577	183,530	58,374	100 bbls.	100	Lime.
		4,746	176,616	81,000			
		3,733	133,748	46,000			
		3,511	128,152	35,500	6.000 tens	90,000	Asphaltum (rock).
48,127	\$16,845	2,509	95,743	3,000	300 bbls.	600	Lime.
10,000	5,000	867	36,648	900		000	Ziiiic.
30,000	15,000	317	15,510	400	1 4,500 tons	55,000	Asphaltum (rock).
					1-15	218,205	Unapportioned, 1900-1909
22,310 38,092	11,155 25,146	563 569	25,476 26,180	75	13,000 tons	165,000	Asphaltum (rock).
2,129	1,469	666	27,998				
-,	1,200	1,160	46,667	134			
		1,266	62,097				
		1,473	125,542	99,475	,	1,940	Bituminous rock, chromite.
11,670	5,252	1,227	114,724	49,318	356 lbs.	88	Copper.
					(	2,717	Bituminous rock, pottery clay, sand- stone.
74.143	68.656	1 565	151.034	8,422		16,886	Bituminous rock, brick, manganese,
	00,000	2 000	101,001	0,122		20,000	soda.
62,744	56,783			6,100	1,907 tons	81,926	Manganese ore.
02,111	00,100			0,100	(	174,447	Bituminous rock, copper, gold, min-
31,656	32,922	6		20,300		199 777	eral water, quicksilver, silver, soda. Bituminous rock, manganese, quick-
51,050	02,322	· ·		20,300		132,777	silver, sandstone, soda.
42,511	59,515	1,224	89,186	6		246,463	Copper. granite, manganese, soda.
							Copper. granite, manganese, soda, miscellaneous stone.
30,725	43,691			80,000		6,100	Chromite, diatomaceous earth, min-
33,856	31,892			107,000		0.570	eral water. Chromite, diatomaceous earth, min-
00,000	01,092			107,000		2,578	eral water.
32,988	19,793			46,479		78,977	Chromite, diatomaceous earth, min- eral water, quicksilver, soda (salt
31,222	30,972	6		113,384		137,436	cake). Mineral water, natural gas, quick-silver, sodium sulphate.
			\$2,168,385				
466,173	\$424,091	648,308		\$939,635		\$1,518,307	

## ANTIMONY.

Stibnite, the common ore of antimony, occurs near the head of San Simeon Creek and on its south fork near the summit of the Santa Lucia Range. The deposits are of doubtful commercial value.

Marquat Estate Deposit. A quartzitic vein, three feet in width with about one foot of stibnite on the footwall, has been uncovered on this property. The vein is in Franciscan sandstone. It strikes NE. and dips 70° NW. One shipment of ore was made years ago and a little prospecting was done at this locality during the war period, but nothing recently. Owned by the Marquat Estate, Mrs. Bena Marquat, administratrix, San Luis Obispo.

Bibl: State Mineralogist's Report X, p. 579; XV, p. 676. State Min. Bur. Bull. 91, p. 29.

#### ASBESTOS.

Asbestos of uncertain quality and in unknown amount occurs in the mountains between Poso and Hasbroucks. It is said that a shipment was made from here a number of years ago, but the fiber was of such short length that the product did not bring a profitable return. This is the only deposit of asbestos of record in the county. The locality was not visited.

# ASPHALT.

Natural asphalt was formerly used a good deal in this state for paving, and San Luis Obispo was a considerable producer of it. Of late years, however, the natural product has been displaced by the material yielded in crude oil distillation, as the latter is more uniform in quality and more cheaply obtained.

The principal natural deposits were on Tar Spring Creek, 9 miles east of Arroyo Grande, and in the bituminous rock area near Edna. There has been no output of natural asphalt from either locality for

many years.

Bibl: State Mineralogist's Reports VII, p. 97; XII, p. 30; XV, p. 676. U. S. Geol. Survey XXII Annual Report, Part I, p. 412; Mineral Resources 1883–84.

#### BITUMINOUS ROCK.

Sands of the Pismo and Santa Margarita formations which have been saturated with and cemented together by natural asphalt, are of wide-spread occurrence in San Luis Obispo County. The asphalt comes from the underlying Monterey shales and when it seeps up into the overlying sand it changes the latter into a tough weather-resisting stratum.

The deposits have been most extensively developed near Edna, a station on the Southern Pacific railroad about six miles south of San Luis Obispo. Other quarries have been opened along and near San Luis Bay; near the town of Arroyo Grande, and on Tar Spring Creek, 9 miles east of Arroyo Grande, where natural asphalt was also refined years ago.

With one exception all the quarries that were formerly worked have

been idle for many years.

Consolidated Bituminous Rock Co. This company owns a large tract of land one mile southwest of Edna, about 40 acres of which contains workable deposits of bituminous sandstone. It was worked at irregular intervals for a number of years, but has been idle since 1920.

J. F. Beckett, of Arroyo Grande, has a deposit but has made no production.

Bibl: State Mineralogist's Reports VII, pp. 53, 97–99; VIII, p. 533; X, p. 571; XII, p. 29; XIII, p. 37; XV, pp. 83–85. U. S. Geol. Survey San Luis Folio 101.

# BRICK AND CLAY.1

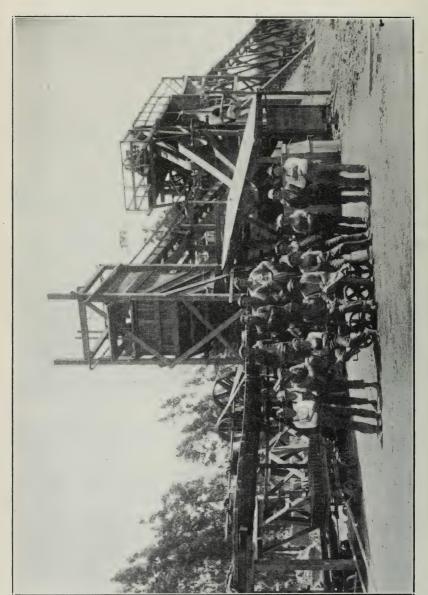
There are no known deposits of high-grade clays in this county, but red-burning clays suitable for making brick occur in the valley silts of recent origin at various places. Since the population of the county is small, the demand for clay products is limited, and a single common brick plant at San Luis Obispo supplies the market of the county, as well as of a few nearby towns in Santa Barbara and Monterey counties. The territory to the south is supplied by brick yards in Santa Barbara, while plants in Gilroy and San Jose furnish brick for the communities in Monterey and San Benito counties.

San Luis Brick Works (formerly San Luis Brick Co.). This property is owned and operated by Faulstich Bros., San Luis Obispo. The plant is located one mile south of town near the lines of the Southern Pacific and Pacific Coast railroads. The clay used is a yellowish loam, with little or no overburden. The proportion of sand is sufficient to prevent excessive shrinkage and cracking in the brick-making process, yet is not so high as to interfere with the binding properties of the clay. The clay is mined to a depth of 15 feet by hand shoveling into dump cars, which are hauled up an incline by a steam-winch, and dumped through a hopper into a 10-foot dry pan. After screening, the fines pass to a pug mill, then to an American Clay Machinery Co.'s auger machine equipped with a Freize cutter. The oversize from the screen is returned to the dry pan.

The brick are dried in the open without auxiliary heat; this requires an average of three weeks. Burning is done in open field kilns, usually with 18 arches, each kiln containing 590,000 brick. Heat is supplied by oil, with steam atomization. Firing requires five days, and cooling about three weeks. The plant operated three months during the season of 1925, producing about 1,500,000 brick. Twenty-eight men are

employed when in full operation.

¹ From notes supplied by W. F. Dietrich, who is preparing a report on the clay resources of California for the State Mining Bureau,



Plant of San Luis Brick Works, San Luis Obispo. Photo by courtesy of the company.

## CHROMITE.

Chromic iron ore has been one of the staple mineral products of this county since the seventies. The output has varied, however, in accordance with the market demand and price, ceasing altogether between 1896 and 1914. During the emergency created by the World War, mining was resumed on an enlarged scale, more than 10,000 tons being produced in 1918. At the ending of hostilities in the latter part of 1918, the market collapsed and chrome mining practically ceased. The development work which had been carried on, however, resulted in the opening up of ore reserves sufficient to supply the present Pacific coast requirements for many years.

Previous reports still available describe the mines and prospects in detail. These detailed descriptions will not be repeated herein, the following supplementary notes being intended to show the present status of the properties only. Those properties which were located as mining claims on public land are, with a few exceptions where assessment work has been kept up, abandoned. Deposits on privately owned lands that were worked under lease almost without exception have reverted to their owners and are idle. At one or two mines a little development work has been carried on and a small production made.

Alvisa and Sunshine Claims. Located in Sec. 34, T. 29 S., R. 12 E. Abandoned.

Castro Mine. This mine is situated in the east half of Sec. 29, T. 29 S., R. 12 E. It was equipped with a 50-ton concentrating mill and has been a large producer. Operated during the war period by the California Chrome Co. The property is patented. Owned by Alfred A. Wheeler, 1640 Clay street, San Francisco. Idle.

Chorro Creek Mine. Located in Sec. 34, T. 29 S., R. 12 E. Abandoned.

Colorado Chrome Mine. Located in Sec. 32, T. 29 S., R. 12 E. Abandoned.

Cypress Chrome Mine. In Sec. 34, T. 29 S., R. 12 E., adjoining the Chorro Creek. Abandoned.

El Divisadero Chrome Mine. This property is in Sec. 33, T. 29 S., R. 12 E. It is patented and owned by L. H. Butcher Co., 274 Brannan street, San Francisco. Idle.

El Salto Chrome Mine. Situated on the west half of Sec. 33, T. 29 S., R. 12 E. Patented land. Owned by L. H. Butcher Co., 274 Brannan street, San Francisco. Idle.

Evans Ranch Deposit. In Sec. 2, T. 25 S., R. 6 E., on W. J. Evans Ranch. Idle.

Froom (Mrs.) Ranch Deposit. Situated in Sec. 8, T. 31 S., R. 12 E., on Laguna Rancho Grant. Idle.

Johe Ranch Deposit. Located in Sec. 2, T. 31 S., R. 11 E. This property is now a part of the holdings controlled by McKinney Iron Mines. Idle.

La Primea and La Trinidad Chrome Mines. Property consists of 180 acres of patented land in Sec. 33, T. 29 S., R. 12 E. These mines

were good producers. Owned by L. H. Butcher Co., 274 Brannan street, San Francisco. Idle.

Lucky Jack Group. This group is in Secs. 29 and 31, T. 29 S., R. 12 E. All claims, except the Lucky Chrome upon which assessment work is kept up, have been abandoned. Production has been about 45 tons. Owner, W. M. Duff, San Luis Obispo.

Middlemast Chrome Deposit. On the W. C. Middlemast Ranch in Sec. 25, T. 28 S., R. 10 E. Idle.

Mutual Chrome Mine. Comprised 80 acres in Sec. 35, T. 29 S., R. 12 E. Abandoned.

London Chrome Mine. This property produced about 3500 tons of ore when last operated during the war period. Development work carried on before the collapse of the chrome market in 1918 revealed extensive reserves of ore which have not as yet been mined. The map herewith shows the underground workings and orebodies developed. Owners, W. C. H. Dibblee and P. A. H. Arata of San Luis Obispo. Idle.

Norcross Chrome Mine. Situated in Sec. 13, T. 29 S., R. 11 E. This mine was under lease to the Union Chrome Co., of San Francisco, during the war period. A mill was erected and a fair tonnage of concentrates averaging 44% Cr₂O₃ was made. Idle and probably abondoned.

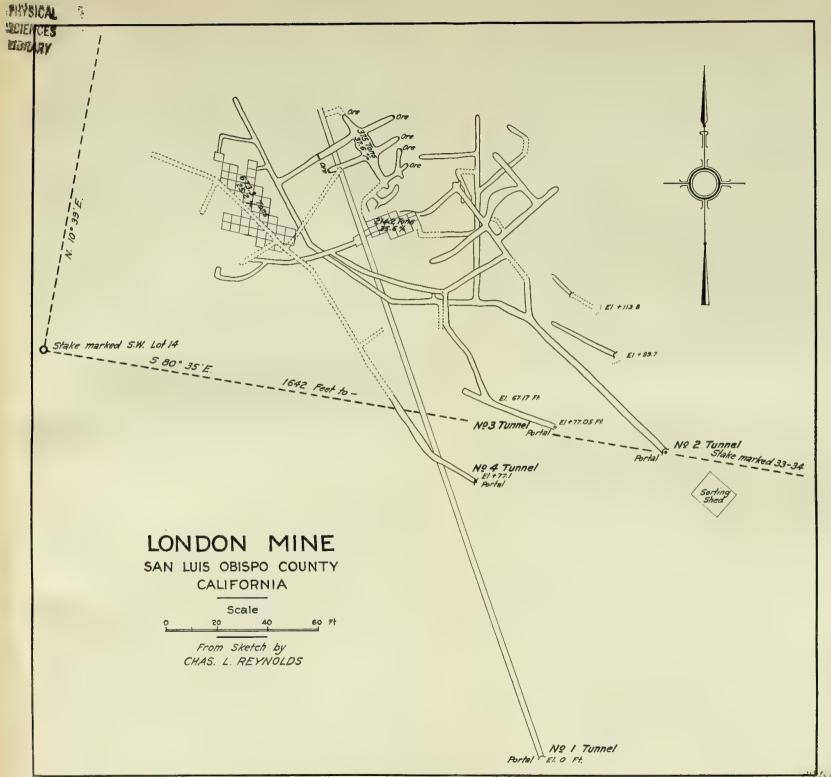
Pick and Shovel Mine (also called Safety Chrome Mine). This property comprises 83.2 acres in the SE¹/₄ of Sec. 34, and the SW¹/₄ of Sec. 35, T. 29 E., R. 12 E. It was worked more extensively in the early days than any other chrome deposit in the district and produced a large tonnage between 1880 and 1890. Many of the old workings were caved, but the mine was reopened when the acute demand for chromite was created during the war, and over 4000 tons of high-grade ore have since been produced. Extensive development work uncovered large reserves which were not drawn upon before the ending of hostili-The limited tonnage of domestic chromite consumed on the Pacific coast since the war period has come mainly from this property, and the owner is prepared to contract delivery of any required tonnage. Pick and Shovel is the only producing mine in the county at the present time, one or two men being engaged in doing additional development and mining. The workings are shown on the accompanying map. Owner, P. A. H. Arata, San Luis Obispo.

Pine Mountain Group. The claims are in Secs. 3 and 10, T. 26 S., R. 8 E. About 400 tons of good chromite was produced here in the eighties. The group is now a part of the Wm. R. Hearst Ranch holdings, having been purchased by the Hearst interests.

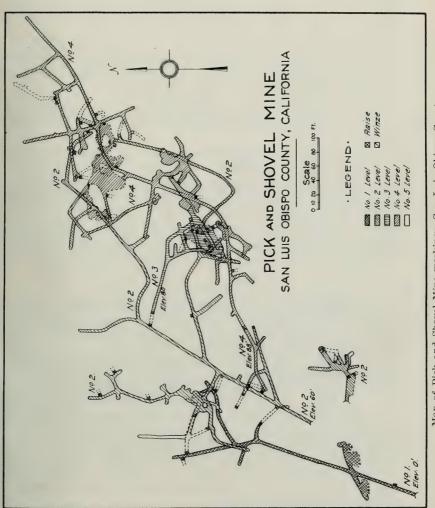
Percira Group. This group comprised three claims, located in 1918, in T. 25 S., R. 8 E. They were soon after sold and are now a part of the large land holdings of Wm. R. Hearst.

Rancho Piedra Blanca. Undeveloped deposits occur on this property, owned by Wm. R. Hearst. They are on Sec. 4, T. 25 S., R. 7 E.

Rancho Santa Manuela. Chromite has been found on this property, six miles northeast of Arroyo Grande.







Map of Pick and Shovel Mine workings, San Luis Obispo County.

Rancho Santa Rita. Some chromite was shipped from here in the eighties. It is eight miles northeast of Cayucos.

Russ Deposit. A small deposit was opened up on this ranch in Sec. 4, T. 25 S., R. 6 E. Antone D. Russ, owner. Idle.

San Bernardino Creek Deposit. E. L. Ellberg, of San Luis Obispo, and H. L. Flournoy, of Morro, have made a small production of chrome ore from deposits near the headwaters of San Bernardino Creek in T. 29 S., R. 11 E.

San Carpojaro Creek and Arroyo La Cruz Deposits. These two claims were located in Sec. 12, T. 25 S., R. 7 E. An orebody about five feet wide was exposed here, but the locality is almost inaccessible. Probably abondoned.

Sweetwater Chrome Mine. This property is in Sec. 12, T. 29 S., R. 11 E. It was a good producer of high-grade ore. W. W. Pierce et al., of Morro, owners. Idle.

Welsh Ranch Deposit. A small lens of chromite was uncovered here in Sec. 4, T. 31 S., R. 11 E. Idle.

Zerfing Ranch Deposit. This deposit is located on the property of Arthur L. Zerfing of Cayucos. The best ore was in the SE₄, Sec. 24, T. 28 S., R. 10 E. Idle.

Bibl: U. S. Geol. Surv. Bull. 430, pp. 168–173, 181–182; San Luis
Folio 101. State Mineralogist's Report XV, pp. 674–726. State
Mining Bur. Bull. 76, pp. 167–178.

## COAL.

"In the spring of 1847, a new coal mine was discovered near San Luis Obisco, north latitude 35°. There are now three mines within three hundred miles of Monterey; yet coal was sold, in 1846, from an American whaler, at \$5 a bushel."

Coal was found on the beach at San Simeon in the sixties and the San Simeon Coal Mining Co., said to have been the first mining company started in the county, was soon after organized. The outcrop of the vein was two feet in width and usually covered with water at high tide. A shaft was sunk to a depth of 100 feet, at which point the vein had dwindled to a mere seam and mining was abandoned.

A small seam, not over 15 inches thick, occurs on Pico Creek, about

four miles from the beach, on the Piedra Blanca Grant.

Coal is also reported to have been found between Poso and Hasbroucks. It is probable that this and the other deposits mentioned are too small to invite exploitation.

Bibl: State Mineralogist's Reports VI, p. 118; VIII, p. 532; XII, p. 61.

#### COPPER.

A few small bodies of high-grade copper ore and surface indications of more extensive deposits of low-grade orebodies have been noted at various places throughout the serpentine areas in this county. Many prospects were located in the sixties, and a few shipments of copper

¹ Taylor, R. C., Statistics of Coal, Second Edition, Philadelphia, 1854.

ore were made in the early days to Swansea, Wales. These ores usually carried some gold and silver values as well. The most commonly occurring copper minerals are chalcopyrite and malachite, with occa-

sionally native copper disseminated through the serpentine.

Some ten or twelve copper properties have been described by name in Bulletin No. 50, 'Copper Resources of California,' 1908, and in State Mineralogist's Report XV, 1915–1916. Most of these properties are quite inaccessible, and at the present time there is no activity at any of them. It does not appear likely that there will be an appreciable production of copper from the county in the near future, although the cupriferous belt of the Coast Range is more worthy of attention here than at any other point between its southern end and San Francisco Bay.

The principal mineralization is in the Santa Lucia Range, north and northwest of San Luis Obispo and in Los Osos Hills. Owing to abandonments, changes in names and ownerships, relocations and long periods of idleness, it is difficult to give any connected history of the

copper properties.

Los Osos Mine. This deposit was located in 1864. The vein, 4 to 12 feet in width, was developed by a shaft 230 feet deep. One hundred tons of 18% copper ore was shipped to Swansea, Wales, in early days. The workings have been caved for years. The deposit is on property now included in the holdings of McKinney Iron Mines. It is designated on the map of the latter (see page 518, post) as the Goodwill Copper Mine. There is a possibility that this property may be reopened.

Bibl: State Mineralogist's Report XV, p. 686; State Min. Bur. Bull. 50, pp. 172–173.

The Guerro, Guadalupe, Gloria, Tassajara and Tiptop claims were all locations in T. 29 S., R. 12 E. on copper showings. They are probably all abandoned, as little or no work was done on them.

W. K. Hobson has eight claims between Morro and Toro creeks, eight miles due east of Cayucos.

Refugio claim was located on Chorro Creek, seven miles north of San Luis Obispo. There is reported to be a 4-foot vein carrying native copper and sulphides on this property.

Bibl: State Min. Bur. Bull. 50, pp. 172–174.

Prodical Son. This claim was located six miles east of Cayucos, between Toro and Old creeks. The ledge carried chalcopyrite, gold and silver, and was opened by a 50-foot shaft.

Bibl: State Min. Bur. Bull. 50, p. 173.

Schneider and McCles Claim was on San Bernardo Creek, seven miles east of Morro.

Bibl: State Min. Bur. Bull. 50, p. 173.

Silver Swan Mine, embraces two claims, owned by R. D. Hazzard, of Cayucos, and located eight miles east of Cayucos, near the headwaters of Morro and Toro creeks. There is a 300-foot tunnel on the property. It is said to have produced some copper.

Bibl: State Mineralogist's Report XV, p. 686.

Sky Scraper. This claim is in the same vicinity as the Silver Swan. It was developed by two tunnels which tapped a vein about 10 feet wide carrying chalcopyrite. Wm. Drought, Cayucos, last known owner.

Bibl: State Mineralogist's Report XV, p. 686; State Min. Bur. Bull. 50, p. 173.

Take-a-Chance Group, included 30 claims owned by James Wheeler et al., of Santa Margarita, covering copper showings in the form of native copper, malachite and chalcopyrite, in a belt near the summit of the Santa Lucia Range, four to seven miles south and west of Santa Margarita at an elevation of 1500 to 2000 feet. This group included a number of former claims that had been abandoned. It is understood that some of these claims are still held by the locators.

Bibl: State Mineralogist's Report XV, p. 686.

# DIATOMACEOUS EARTH.

White, chalk-like beds of diatomaceous or infusorial earth are associated with other Tertiary sedimentary formations over an extensive area in the Coast Range.

The belt running through the southern part of Monterey County continues south into San Luis Obispo. Many detached exposures of diatomaceous earth have been noted here, but they have only been utilized to a limited extent up to the present time.

A deposit in Sec. 23, T. 26 S., R.10 E., near Adelaide, was worked for a time in 1880, the material being sold as 'Magic Polish.' The bed here is reported to be six feet thick and to cover 25 acres.

Undeveloped deposits occur about three miles north of Arroyo Grande,

close to the Pacific Coast Railroad and in Verde Canyon.

A bed is exposed close to the Southern Pacific Railroad, opposite Edna.

Other deposits have been noted in the mountains back of Pismo and at various points along Salinas Valley as far south as Rinconada Valley.

An undeveloped deposit of diatomaceous earth is reported to occur on Lots 13, 15, 16 and 17, of San Miguelito Rancho lying south of San Luis Obispo.

Ferrell Deposit. There is a deposit of diatomaceous earth owned by C. E. Ferrell, P. O. Box 156, San Luis Obispo, on Los Osos Creek south of Morro Bay. The bed here is 45 feet in thickness. It is a continuation of that on the property of the Incello Company. There is a good road from the deposit to San Luis Obispo, a distance of 11 miles.

Hazzard Gragg Deposit. A deposit of cream-colored diatomaceous earth has been opened up by a 90-foot tunnel on the Rancho San Miguelito. The deposit is on a tract of 168 acres, owned by Hazzard Gragg. It is on the coast highway, 2 miles south of Avalon. There has been no commercial production to date.

Incello Company, The. This company controls about 1000 acres of land, formerly a part of Cañada de Los Osos Grant, on which there is a large deposit of diatomaceous earth. The deposit is on the south side of Los Osos Valley, about two miles south of Morro Bay and ten

miles west of San Luis Obispo, the nearest railroad shipping point. The company also has a plant adjacent to the Southern Pacific and Pacific Coast Railroad lines, near the end of Broad Street, San Luis Obispo, for the manufacture of insulating brick.

The Incello Company was organized about three years ago, absorbing the U. S. Refractories Co., which had made a small production before the reorganization. The present company has not been fully financed, and the plant has not been in operation recently. Robert W. Hull is president, and N. J. Shields, secretary; home office, San Luis Obispo.

The deposit of diatomaceous earth controlled by the company outcrops at an elevation of 250 feet. An excellent gravelled highway through Los Osos Valley extends to within a half mile of it. From the highway to the loading bunkers there is a planked road over low sand dunes which intervene. A Clyde hoist is housed above the bunkers, and a tramway extends from here to the quarry face at the bottom and on the opposite side of a small gulch. The tramway has a slope of approximately 30° and a length of about 400 feet. The strike of the bed where mined is northwest and it dips 45° southwest into the hill. An adit 60 feet in length run as a cross-cut is entirely in the white diatomaceous earth. Other development consists of numerous test pits and trenches on both sides of the gulch.

The brick plant is equipped with a Williams hammer mill, dry pan, pug mill, Fernholtz-Formo press, dryer, cars, etc. For burning, there are two round 30-foot bee-hive type down-draft kilns holding 80,000 brick, and two smaller experimental kilns. Each unit is equipped with individual motors for electric power operation. The plant has a capacity of 10,000 brick per day. It is uncertain when the company

will again be in production.

Pismo Heights Company. This company has a deposit of diatomaceous earth on their property, one-half mile north of Pismo between the State Highway and the Southern Pacific Railroad. It is undeveloped. W. E. Wolfe, manager, Pismo, California.

#### DOLOMITE

There is a deposit of white dolomite in Sec. 13, T. 30 S., R. 13 E., at the upper end of Little Falls Canyon, a branch of Lopez Canyon.

S. Aumaier, 1127 Monterey Street, San Luis Obispo, and Peter Roderjuez have located one claim here. It is accessible by trail only, as the nearest roads terminate several miles from the deposit. A sample analyzed by Smith, Emery and Co., of San Francisco, gave the following results:

SiO ₂	0.40%
$Al_2\tilde{O}_3$	0.19
$\operatorname{Fe_2O_3}$	0.05
CaO	31.70
MgO	20.44
Loss on ignition	47.36

100.14

#### GOLD.

San Luis Obispo can scarcely be considered as one of the gold producing counties of the State, although gold was probably mined here before 1848. There is no record of the output previous to 1882, but it is thought that it amounted to at least \$100,000, as several hundred men were working for a time. Most of the metal has been obtained by ground sluicing and panning. The Franciscan metamorphics of the Santa Lucia range have fed a little gold into the streams on both sides of this range. San Marcos creek, west of Paso Robles, was worked, as well as a number of streams on the west slope. The Nacimiento River is being prospected just below the mouth of Las Tablas Creek at the present time. The best known and most important placers, however, have been in the gulches heading in the granitic area of the San Jose range in the vicinity of La Panza and Pozo. Some work is going on in this section at the present time, and there is probably a small annual output, although it may not always become of record. There are no quartz mines in the county. A 10-stamp mill was erected by the Cuesta Gold Mining and Milling Co. at a property a few miles northwest of San Luis Obispo, about 15 years ago, but it was only operated a short time. After doing some work which failed to develop ore, the mine was abandoned and the mill dismantled in 1913.

Morning Star Placer Mining Co. This company is out of existence, and its claims in Secs. 6, 7, 8, 17, 18, 19 and 20, of T. 30 S., R. 17 E., have been abandoned. Sixty acres on San Lorenzo Creek, formerly a part of their ground, has been taken up by T. H. Williams, J. W. Monell, and Mrs. Martha Williams, who work it by ground sluicing when water is available.

Navajo Mines. This property is on Navajo Creek. Owner, Bert Alley, Pozo, California. There is considerable ground here which the owners claim will run 50¢ per yard and could be dredged. A homemade placer machine, run by a gasoline engine, is being used by the owner, who has been operating quite steadily.

Queen Bee Mine. Owner, Henry Chester, 5701 York Blvd., Los Angeles, or Pozo, California. This property comprises approximately 200 acres on Mineral Creek, which have been held by the present owner since 1896. The deposit is composed of uncemented gravel of medium size with an average depth of 12 feet. The bedrock is granite. It has been worked to a considerable extent by ground sluicing. occur from the surface down and are fairly evenly distributed. gold is coarse and somewhat rough, running from 25¢ pieces up, with occasional nuggets worth \$5 to \$6. It is said to be very high grade, assaving \$19.65 to \$19.75 per ounce, and is sought by jewelers and dentists on account of its easy working qualities and purity. Most of the production has been sold to such buyers. The property has been recently examined by Los Angeles parties who contemplate putting on a machine capable of handling the gravel on a fairly large scale. An additional water supply is being developed, and the owner is also doing a little work on a 3-foot quartz vein found here, which shows low values. The recent dry season has curtailed sluicing operations.

Still Ranch Property. Owner, O. S. Still, La Panza, California. This property is in T. 29 S., R. 16 E. About 400 acres in Sec. 30 is

considered to be mining ground. The elder Mr. Still came into the region over 45 years ago and engaged in placer mining with several hundred other Americans, Mexicans and Chinese. As the richer surface placers were worked out and abandoned the present owner acquired the ground, which now has become a part of the ranch. For 35 years past but little attempt has been made to mine it, although some gold has been recovered with rockers by prospectors and itinerant miners, who were seeking a grubstake. Water for working has been limited in recent years.

A Pierce gold-saving machine, constructed and owned by R. A. Pierce, Morro Bay, is on the property, but was not in operation when visited. Similar machines have been installed by Mr. Pierce at several other

localities in central and northern California.

# GYPSUM.

No deposits of gypsum of economic importance have as yet been developed. It occurs, however, in limited quantity as white bunches and veins on Alamo Creek, 16 miles from Santa Maria, and in the form of alabaster at Arroyo Grande. Gypsite, an impure form, is found in beds on the southwest side of the Tremblor Range, east of Carrizo Plain, and crystals of selenite occur in the clays along Carrizo Creek.

Bibl: State Mining Bur. Bull. 91, p. 271.

# IRON.

Iron ore represented principally by an extensive deposit in the Los Osos hills, five miles west of San Luis Obispo, is one of the most

important latent mineral resources of the county.

Diverse ownerships and interests have heretofore prevented this entire field being considered as a unit, and it has not attracted the attention which its favorable location near tide water, extent and the character of the ore seemed to warrant. During 1924 the various interests were united, and the combined properties present a strong argument for the establishment of the initial plant of an iron and steel industry here; whether this takes the form of blast furnaces, some process using petroleum fuel in the direct reduction of iron, or a combination process using low-grade fuel, such as lignite or petroleum by-products, in the production of sponge-iron and electric melting of the sponge.

A process of the latter character, which eliminates entirely the need of coke and permits the direct production of steel from iron ore by the use of fuel oil and its by-products, has lately been developed by the

Wakama Iron and Steel Co., a California corporation.

A great deal of experimental work has been carried on by this company and the process has been demonstrated under the supervision of Smith Emery and Company, Testing Engineers, at various commercial foundries in the San Francisco Bay district having electric furnaces. Pours of over a ton of metal have been made by the regular foundry crews from charges composed of ore reduced in retorts by this process. The analyses of the resulting steel and its physical properties have been attested by Smith Emery and Company.

The favorable results attained by the use of such available equipment seems to point to the unqualified metallurgical success of this method of producing steel in a plant primarily designed to use it.

This direct steel process, which was patented in the United States in 1920, and for which foreign patents are pending, is designed to produce steel directly from iron ore without the necessity of making pig iron as an intermediate step. It consists essentially in the reduction of the ore to iron sponge by the agency of ordinary carbonaceous fuels, and the melting of the sponge immediately on its formation, producing steel of a predetermined composition, the process being continuous. It differs from previously proposed methods in that the material is not allowed to cool from the beginning to the end of the operation; nor is the sponge exposed at any time to the oxidizing effect of the air or the furnace gases. The importance of excluding the air and steam from the heated sponge, which absorbs oxygen with the greatest avidity is well known. It is, in fact, this propensity which has here-tofore rendered nugatory all attempts to manufacture solid iron from it.

In carrying out this process, pulverized iron ore is taken and thoroughly mixed with carbonaceous fuel, either liquid or solid, and placed within metallic retorts. Any fuel will answer, provided it will leave a residue of fixed carbon on heating. The value of the different fuels, as powdered coal and coke (screenings), charcoal, the residue of gas works and oil refineries, etc., has been determined on a working scale and as applied to the different ores of iron, and very interesting facts have been brought out. The proportion of fuel required varies inversely as its fixed carbon when applied to the reduction of magnetic ore, on which the volatile constituents seem to have little effect. But limonite, and to a less degree hematite, are amenable to the action of even quite volatile gases.

Having mixed the ore with the fuel, whose fixed carbon may average 20 per cent of the weight of the metallic iron in the ore, the mixture, to which the necessary fluxes are also added, is placed in the retort, which may be either spherical or cylindrical in order to roll, and charged into the cooler end of the furnace, in which it is brought to a bright red heat and kept so for some hours, during which the ore is deoxidized; the iron being left in a powdery condition or at the highest practical heat sintered into a porous mass about as coherent as a half-burnt brick.

The furnace in which the foregoing process is carried on is a very long reverberatory, similar to the heating furnaces used in rolling mills. It has preferably a sloping hearth to facilitate the travel of the shells (retorts) which cover its hearth and roll parallel to each other from the cold to the hot end. It is heated partly by an independent fire at the hot end, but mainly by the combustion of carbon monoxide. Thus, there is no loss of the fuel in this process, except by unavoidable radiation from the long furnace.

The reaction being complete, the ore thoroughly reduced and the shell with its contents at the highest permissible temperature, a door which separates the reducing furnace from a melting compartment is opened and the shell allowed to roll into the latter, where it with its contents is melted down, producing liquid steel.

By the integral construction of the two furnaces, making them practically one, and by other devices, the inventor has succeeded in

making the process continuous, and to a certain degree automatic. There is no manual labor connected with the charging or discharging of the reduction furnace. As for the shells, they are east from the molten metal from the melting furnace, and weigh about one-third as much as the iron they enclose. It should be mentioned that apertures are left in them for the escape of the gases, which would otherwise tend to rupture them. Experience shows that from six to eight hours' exposure to gradually increasing heat is required for the reduction of a shell holding 300 lb. of iron ore, the ore being magnetite.

There must be, therefore, a large number constantly under treatment, and in the projected works it is the intention to use furnaces having a capacity of 100 shells or more at any time. The shells lie parallel and in contact during their passage through the furnace, and receive the heat produced by the combustion of the gases which issue from their interior, as well as that due to the fire at the end of the furnace.

There is nothing novel about the melting compartment, a common open-hearth or electric furnace in which the steel collects and is duly tapped and poured out. It will be readily understood that the melting takes place rapidly, since the materials are already nearly at the fusing point when they enter the furnace, thus bringing about a considerable saving of time and fuel and preventing undue wear and Attention is called to the difference between this and ordinary practice. In the new method the materials are charged hot and almost instantaneously; in the older they are charged cold and in installments, occupying often an hour or more for a single charge. during which time the side doors are open, causing great loss of time and heat. Further, the temperature of the interior oscillates with constant damage to brickwork. These drawbacks are avoided in the working of the new process, though it is fair to say that it is not intended to use the melting compartment for refining the steel. auxiliary furnace will be used for that purpose, the metal being tapped into a ladle, transferred to the refining furnace, and there treated with the additions and brought to the proper composition and temperature for casting. It is evident that this work could not well be performed in the primary furnace, since the reduction furnace requires to be run at a regular pace in order to do its best work, and could not by any means be allowed to wait upon the melting department. It is considered that an allowance of one square foot of open-hearth area would suffice for the melting of one ton of steel in twenty-four hours under these conditions, but in order to meet the extra work imposed by the occasional presence of unreduced ferrous oxide in the retorts, this allowance will be increased to 1\frac{1}{3} square feet.

The metal thus far in quantities up to a ton or two at a heat has proved fully equal in quality to corresponding grades of commercial steel and ranges in composition from soft steel of point 20, up to the hardest kind with one per cent, and even as high as pig iron with three

or four per cent, therefore, it is easily controllable.

It appears that this invention is an important improvement on electric steel making, since it substitutes during the process of reduction the much cheaper heat of ordinary fuels for the costly heat of electric current, only employing the latter for the final melting. Thus, the consumption of current is brought down to less than one-fifth that heretofore employed. If to this consideration is added the superior control which is had over the composition of the product, it must be granted that the new process has a great field of future usefulness.

Claims covered by the letters patent are:

- 1. Reduction of the metal by means of the cheaper and more common sorts of combustibles.
- The intermixture of the combustible with the ore previous to heating.

The reduction inside of closed receptacles.

- The gradual heating through a considerable period of time.
- The exposure, first, to very low temperature, followed by gradually increasing heat, by which fuel is saved and a more perfect reduction insured.
- The use of metal containers, impermeable to gases, by which the reduced iron is prevented from reverting to oxide.
- The circular form of container which admits of its being rolled forward in the furnace.
- The automatic forward feed of the containers along the downwardly sloping furnace bed without labor or attention of any kind.

The manufacture of the containers which will be carried on at the furnace side, by means of a semi-automatic mechanism, using

steel direct from the crucible before refining.

The arrangement of a movable door or gate between the reduction chamber and the melting chamber, by which the hot containers are rolled quickly into the latter, without loss of heat from either chamber, and without the possibility of air entering the contaners and oxidizing the sponge within them.

The method of casting the containers from the melting chamber

at a minimum of expense.

Providing hot materials to the melting chamber, instead of the usual cold charge, by which the melting is much facilitated and cheapened.

12. The heating, also in containers, of the 'additions' of lime, ferro-manganese, ferro-silicon, etc., and their incorporation with

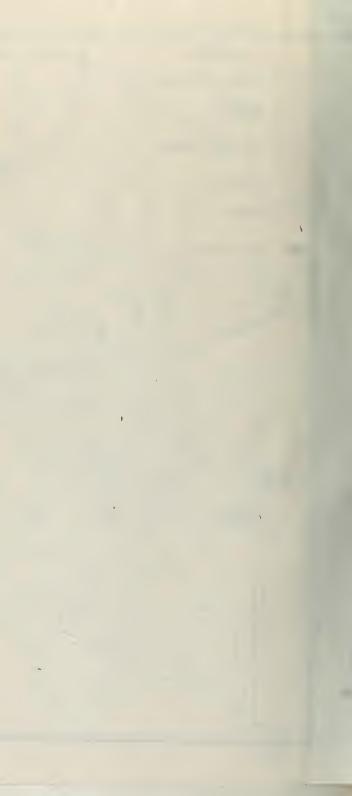
the melting charge.

A variety of products have been made by this process, ranging from a very soft iron containing not more than 0.01% carbon, through different grades of steel, up to the highly carburized material with two per cent carbon of exceeding hardness and suitable for stamp shoes and dies. Steel, for any use whatever, can be manufactured in this way, simply by varying the amount of combustible mixed with the ore, giving attention at the same time to the 'additions' made during the melting. And since manganese ore is reduced in the containers in the same way as iron, a very simple method of providing the ferro-manganese necessary is obviously open.

It is claimed that no other process of steel-making opens so many avenues for the manufacture of alloys, or is so easily controllable; and,

further, that in no other process is there so little waste of fuel.

McKinney Iron Mines. This property includes all of the leaseholds controlled by W. McKinney and associates of San Luis Obispo covering the iron ore deposits in that part of the San Luis Range commonly called the Irish Hills or Los Osos Hills. The holdings comprise Lots



38, 39, 40, 70, 71, 72, 73, 74 and 48 of Rancho Cañada de Los Osos and la Laguna, lying mainly in what would be T. 30 S., R. 10 E. The most easterly outcropping of ore is in Prefumo Canyon and within 2½ miles of San Luis Obispo. From this point the iron ore veins have



Outcrop of iron ore on west side of Prefumo Canyon, McKinney Iron Mines, San Luis Obispo County.



Outcrop of iron ore west of Clark Valley, McKinney Iron Mines, San Luis Obispo County.

recently been traced in a general direction of N. 80° W. for a distance of approximately 5½ miles. The accompanying map of McKinney Mines shows the area, topography, and number of veins, as indicated by their outcrops.

Both hematite and limonite ore occurs. At the eastern end limonite predominates, the most prominent exposure in Prefumo Canyon being a well-defined vein of dark brown or black glossy limonite, 10 feet in width. This vein or bed strikes N. 70° W. and stands nearly vertical. The walls are ferruginous sandstone and shale of Franciscan age. The ore has a laminated structure, the banding being parallel to the strike of the vein and bedding plane of the enclosing sedimentary formations, indicating contemporaneous deposition. Regarding the genesis of these iron ores. Harder, who examined the eastern end of the deposit in 1910, says:

"It seems clear that the iron ore of Prefumo Canyon is an original sedimentary deposit formed during an interval in the deposition of the inclosing sandstones and shales. The character of the ore, the bedding and fine laminations, and the included sedimentary beds all point to this conclusion. It is probably of the nature of a bog deposit which has been consolidated during the compression and folding of the accompanying strata * * *

"The ore may have been deposited in a circular basin with a probable diameter of 5000 feet or more, which is the present length of the deposit,² or in an elliptical basin with one diameter of 5000° feet or more. Subsequent erosion after tilting has removed a large part of the bed. If it is considered that the deposit was originally circular in outline and that about half of it has been eroded, the vertical bed as it remains would have a depth of 25004 feet or more at the center and would gradually decrease in depth towards the ends. On the assumption that the bed has a fairly regular thickness of 10 feet, there would in this case be a great tonnage of low-grade ore left in the ground. However, the bed may have been originally elliptical instead of circular in outline, and if so the quantity of ore is uncertain within a wide range, depending upon whether the larger diameter is horizontal or vertical. Another uncertain factor is introduced by the fact that either more or less than half the bed may have been eroded. * * *,

The writer finds no reason to disagree with the theory of origin quoted, and allowing for the fact that the veins may vary in thickness or pinch out in places and that the grade of the ore may change, it still seems certain after considering the number of veins uncovered since Harder's examination and the distance over which they outcrop, that an enormous tonnage of ore is left in the ground. As confirmatory evidence, it is noted that the outcrops are found in place at points having a difference in elevation of nearly 1200 feet, but the only positive evidence of continuation at depth is at one point where a crosscut has intersected the ore at a depth of 150 feet below the surface.

The continuity of the several veins on their strike has not been definitely established, but continuous exposures, running 250 feet, are found and the thickness of the individual veins appears to be fairly consistent throughout their length. These widths vary from 10 to 30 feet. The veins on the eastern half converge at Johe Hill, where they have been somewhat disturbed, probably by igneous intrusions. Farther west above the old Goodwill Copper Mine, the formations are also disturbed, and the veins badly shattered. There is an exposure here of 30 feet of hematite ore. The veins from this point westward and across Clark Valley are in the main hematite.

¹ Harder, E. C., Some Iron Ores of Western and Central California, U. S. Geol. Survey Bull. 430, pp. 220-223, 1910.
² Later exploration has shown the orebodies to extend more than five times this

distance.

³ See Footnote 2, ante.

⁴ See Footnote 2, ante.

# The following analyses are given by Harder¹:

1. Ore outcrop near creek (Prefumo), 11 feet of ore 2. Ore outcrop 2000 feet southeast a of No. 1 3. Ore outcrop 3000 feet northwest of No. 1 4. Mixture of samples 1, 2 and 3—	44.80 47.60	$Phosphorus \\ 0.500 \\ 0.530 \\ 0.510$	Silica 15.41 11.20 13.10
Iron         46.16           Silica         13.28           Phosphorus         0.513           Alumina         1.42           Lime         6.0           Magnesia         Trace           Manganese         0.20           Sulphur         0.639           Titanic acid         None			
^a Evidently from outcrop not on McKinney Iron Mines 1	property.		

Samples taken from the various veins by Mr. McKinney at points judged by him to give a fair average of the entire field are reported as follows:

Silica	Iron	Alumina	Lime	Magnesia	Phosphorus	Sulphur	Manganese
11.19	52.77	1.62	3.40	Trace	.89	Trace	0.46
10.41	49.49	2.40	3.90	Trace	.77	Trace	Trace
16.66	45.33	1.95	Trace	Trace	.45	Trace	0.28
13.60	46.67	3,50	1.08	Trace	.34	Trace	Trace
8.10	51.75	1.78	1.88	Trace	.54	Trace	0.32
12.50	50.21	0.47	2.65	Trace	.68	Trace	0.32
8.47	49.70	4.69	2.95	Trace	.69	Trace	0.84
8.13	52.65	1.63	3.40	Trace	.70	Trace	0.08
8.74	53.05	0.74	3.25	Trace	.75	Trace	Trace
9.66	47.85	3.07	1.03	Trace	.81	Trace	1.22
14.50	45.09	3.55	3.11	Trace	.67	Trace	0.88
11.60	51.23	2.48	0.39	0.20	.62	.12	1.18
	01.00						
Silica	Iron	Lime	Ma	gnesia	Phosphorus	Sulphur	Manganese
					-		_
7.33	50.52	2.65		0.32	0.58	0.044	Manganese 0.84 0.66
$7.33 \\ 7.11$	$\frac{50.52}{55.10}$	$\frac{2.65}{\mathrm{Trace}}$	Tr	0.32 race	$0.58 \\ 0.227$	0.044 Trace	0.84 0.66
7.33 $7.11$ $6.07$	$50.52 \\ 55.10 \\ 53.85$	$\begin{array}{c} 2.65 \\ \text{Trace} \\ 2.05 \end{array}$	Tr	0.32 ace 0.36	$\begin{array}{c} 0.58 \\ 0.227 \\ 0.62 \end{array}$	0.044	0.84
7.33 7.11 6.07 8.13	$50.52 \\ 55.10 \\ 53.85 \\ 52.81$	$\begin{array}{c} 2.65 \\ { m Trace} \\ 2.05 \\ 1.68 \end{array}$	Tr	0.32 race 0.36 0.50	$egin{array}{c} 0.58 \\ 0.227 \\ 0.62 \\ 0.61 \\ \end{array}$	0.044 Trace Trace 0.033	$0.84 \\ 0.66 \\ 1.80 \\ 1.66$
7.33 $7.11$ $6.07$ $8.13$ $12.55$	50.52 $55.10$ $53.85$ $52.81$ $43.67$	2.65 Trace 2.05 1.68 3.55	Tr	0.32 race 0.36 0.50 race	$egin{array}{c} 0.58 \\ 0.227 \\ 0.62 \\ 0.61 \\ 0.66 \\ \end{array}$	0.044 Trace Trace	$0.84 \\ 0.66 \\ 1.80$
7.33 $7.11$ $6.07$ $8.13$ $12.55$ $12.86$	50.52 $55.10$ $53.85$ $52.81$ $43.67$ $48.24$	2.65 Trace 2.05 1.68 3.55 Trace	Tr	0.32 ace 0.36 0.50 cace 0.50	$\begin{array}{c} 0.58 \\ 0.227 \\ 0.62 \\ 0.61 \\ 0.66 \\ 0.27 \end{array}$	0.044 Trace Trace 0.033 Trace Trace	0.84 $0.66$ $1.80$ $1.66$ $0.40$ $1.03$
7.33 $7.11$ $6.07$ $8.13$ $12.55$	$\begin{array}{c} 50.52 \\ 55.10 \\ 53.85 \\ 52.81 \\ 43.67 \\ 48.24 \\ 50.78 \end{array}$	2.65 Trace 2.05 1.68 3.55 Trace 3.25	Tr	0.32 race 0.36 0.50 race 0.50	0.58 0.227 0.62 0.61 0.66 0.27 0.82	0.044 Trace Trace 0.033 Trace	$0.84 \\ 0.66 \\ 1.80 \\ 1.66 \\ 0.40$
7.33 $7.11$ $6.07$ $8.13$ $12.55$ $12.86$ $5.05$	50.52 $55.10$ $53.85$ $52.81$ $43.67$ $48.24$	2.65 Trace 2.05 1.68 3.55 Trace	Tr	0.32 ace 0.36 0.50 cace 0.50	$\begin{array}{c} 0.58 \\ 0.227 \\ 0.62 \\ 0.61 \\ 0.66 \\ 0.27 \end{array}$	0.044 Trace Trace 0.033 Trace Trace Trace	0.84 $0.66$ $1.80$ $1.66$ $0.40$ $1.03$ $1.46$
7.33 $7.11$ $6.07$ $8.13$ $12.55$ $12.86$ $5.05$	$\begin{array}{c} 50.52 \\ 55.10 \\ 53.85 \\ 52.81 \\ 43.67 \\ 48.24 \\ 50.78 \end{array}$	2.65 Trace 2.05 1.68 3.55 Trace 3.25 Trace	Tr	0.32 race 0.36 0.50 race 0.50	0.58 0.227 0.62 0.61 0.66 0.27 0.82 0.46	0.044 Trace Trace 0.033 Trace Trace Trace	0.84 $0.66$ $1.80$ $1.66$ $0.40$ $1.03$ $1.46$
$\begin{array}{c} 7.33 \\ 7.11 \\ 6.07 \\ 8.13 \\ 12.55 \\ 12.86 \\ 5.05 \\ 9.46 \end{array}$	50.52 55.10 53.85 52.81 43.67 48.24 50.78 51.28	2.65 Trace 2.05 1.68 3.55 Trace 3.25 Trace	Tr T'r T'r	0.32 ace 0.36 0.50 ace 0.50 0.33 0.45	0.58 0.227 0.62 0.61 0.66 0.27 0.82 0.46 thur	0.044 Trace Trace 0.033 Trace Trace Trace Trace Trace	$\begin{array}{c} 0.84 \\ 0.66 \\ 1.80 \\ 1.66 \\ 0.40 \\ 1.03 \\ 1.46 \\ 1.78 \end{array}$
7.33 7.11 6.07 8.13 12.55 12.86 5.05 9.46 Silica	$\begin{array}{c} 50.52 \\ 55.10 \\ 53.85 \\ 52.81 \\ 43.67 \\ 48.24 \\ 50.78 \\ 51.28 \end{array}$	2.65 Trace 2.05 1.68 3.55 Trace 3.25 Trace	Tr	0.32 ace 0.36 0.50 ace 0.50 0.33 0.45	0.58 0.227 0.62 0.61 0.66 0.27 0.82 0.46	0.044 Trace Trace 0.033 Trace Trace Trace Trace	0.84 0.66 1.80 1.66 0.40 1.03 1.46 1.78 Magnesia

Development work up to the present has consisted of surface exploration, surveying and mapping of the deposit; a small amount of cross-

cutting; sinking of test pits and sampling.

The deposit is accessible by road from Los Osos Valley at three points, up Prefumo Canyon at the east end, by way of Andrews Canyon near the center and up Clark Valley at the west. An excellent highway runs the length of Los Osos Valley, connecting San Luis Obispo and Morro Bay. The topography is such that a railroad line could be extended to the deposit at a low cost. The Pacific Coast Railroad main line from San Luis Obispo to Port San Luis passes within  $2\frac{1}{2}$  miles of the eastern end of the property. From here it is eight miles to the harbor. Port San Luis is a deep water harbor and a regular port of call for coast vessels and oil tankers.

Electric power is available within two miles and a large tank farm of the Union Oil Company is situated within three miles of the

deposit.

Accessory minerals utilized in the iron industry are found within

¹ Harder, E. C., U. S. Geol. Survey Bull, 430,

the county, occurring in part on the property; including limestone, dolomite, manganese, chrome, and diatomaceous earth.

W. McKinney, San Luis Obispo, is directing the interests associated in developing the property.

#### LIMESTONE.

Very little limestone has been mined and utilized in this county although many deposits of commercial size and good quality occur. The distance from transportation and limited local market has hindered development, but both of these factors are subject to constant improvement, and the limestone deposits may be considered as assets of considerable potential value.

The limestones occur mainly in the Monterey formation in both the Santa Lucia and San Luis Ranges. Deposits have been noted in Secs. 18 and 19, T. 26 S., R. 10, and some was burned here years ago; in the northwestern part of T. 32 S., R. 16 E., and eastern part of T. 32 S., R. 15 E., and in Sec. 36, T. 32 S., R. 14 E. There is an immense bed of fossil clam and oyster shells near the Oceanic Mine. Limestone has been burned in the past on the Newsom Estate near Newsom Springs. Another unexploited deposit occurs two or three miles north of Santa Margarita. Limestone is found in the San Luis Range on the McKinney Iron Mines property and at other points.

Tassajero Group. Three claims in Secs. 21 and 28, T. 29 S., R. 12 E., which cover a deposit of white, coarsely crystallized calcite, compose this group; owned by S. Aumaier, 1127 Monterey street, San Luis Obispo. The deposit is on the eastern slope of the Santa Lucia near the summit at the head of Tassajero Creek. There is a road up Tassajero Creek to within a short distance and several roads on the west side of the ridge extend as far as the chrome mines in the serpentine area, which cuts off the calcite veins on the south. Several veins have been exposed on the claims by short open cuts, the largest vein having a width of 12 to 14 feet. They have been traced the length of two claims. The property is 4½ miles from Santa Margarita, the nearest railroad station. An analysis of the calcite by Smith, Emery and Co. showed the following composition:

SiO ₂	0.45%
$Al_2O_3$	0.19
$Fe_2O_3$	0.85
$Mn_3O_4$	0.80
CaO	54.24
MgO	0.42
Loss on ignition	43.40
Total	100.35

The sample is unusual in having an appreciable manganese content.

Lopez Canyon Group. This property comprises three claims located in 1924, and owned by S. Aumaier, 1127 Monterey Street, San Luis Obispo, Peter Roderjuez and S. J. Rhyne. They are situated in Lopez Canyon at the corner common to T. 30 S., R. 13 E., T. 30 S., R. 14 E., and T. 31 S., R. 13 E., T. 31 S., R. 14 E., in the Santa Barbara

National Forest. There is a road up Lopez Canyon leading directly to the claims. The limestone bed outcrops several hundred feet above Lopez Canyon Creek in the high ridge on the south side of the canyon, and is exposed at several points along its strike, which is northwest, and parallel with the canyon. The bed dips about 45° SW. into the ridge. The most prominent outcrop is at the junction of Fern Canyon and Lopez Canyon, where the former breaks in. The thickness of the bed is difficult to determine, as the hills are thickly covered with brush, but where exposed at the mouth of Fern Canyon, the ledge apparently has a thickness of 100 feet or more. Several thinner limestone beds cuterop at various elevations on both sides of the canyon.

The owners put up a small home-made kiln and burned a little of the limestone, but had difficulty in getting a high enough heat for complete calcination, as the draft was poor, the kiln being only about six feet in height. The lime that was well burned slaked rapidly and completely. It was white and appeared to be of good quality. No analyses have been made of this limestone, and it may be in part dolomitic.

#### MAGNESITE.

Small veins of magnesite occur on the *Kiser Ranch*, nine miles northwest of Cambria. The deposit is probably of no commercial importance.

Bibl: State Mining Bur. Bull. 91, p. 133. U. S. Geol. Survey Bull. 355, p. 38.

#### MANGANESE.

Several thousand tons of manganese ore were produced in San Luis Obispo County between 1918 and 1920. Active development of the deposits began as a result of the war demand for the metal and ceased when importation of foreign ores was resumed. Many deposits have been noted in the same general areas of the San Luis and Santa Lucia Ranges that produced chromite, and some of these deposits have proved to be high grade and of good size. None of the manganese mines are active at the present time. They have been described in detail in Bulletin No. 76, 'Manganese and Chromium in California,' and will be but briefly referred to in this report.

Evans Deposit. Manganese occurs on the property of W. and J. Evans, of San Simeon, in Sec. 3, T. 25 S., R. 6 E.

Hearst Ranch. There is a deposit on the Hearst Ranch, on San Simeon Creek, three miles from the wharf at San Simeon.

Johe Deposit. Owner, George J. Johe, San Luis Obispo. This deposit is at the head of Clark Valley, in the Los Osos Hills, seven miles west of San Luis Obispo by good road. It is undeveloped.

A. A. Muscio, 793 Buchon St., San Luis Obispo, has a manganese deposit near Cayucos, from which there has been a small output.

Phelan Ranch Deposits. Manganese outcrops strongly in T. 27 S., R. 8 E. on property of the Phelan Land and Cattle Co., R. and Jeff Phelan, Cambria, owners. The deposit is in the Pine Mountain district, eight miles from Cambria.

Riccioli Property. Manganese ore was developed on this property, owned by Victor Riccioli, of Cayucos. The deposit is seven miles southwest of Cambria and  $\frac{1}{4}$  mile from the road between Cayucos and Cambria. It was under lease during the war.

Serrano Deposit. Manganese occurs on the Serrano property in Clark Valley, seven miles west of San Luis Obispo. There is a good road to the deposit. Not developed. Carlos Serrano, owner, P. O. Box 125, San Luis Obispo.

Stanusich Ranch Deposit. This was one of the principal properties worked during the period of the war activity, when it was under lease to the Manganese Co. of California. The deposit is situated south of Clark Valley in the Prefumo Canyon district, eight miles from San Luis Obispo by good road. A streak, six to eight inches wide, of chemical grade manganese oxide, occurs here as well as reserves of industrial grade ores.

Welsh Ranch Deposit. Deposits on this property, owned by J. C. Welsh, 1320 Palm street, San Luis Obispo, were developed under lease, and high grade ore was produced during the war period. The deposit is on the ridge south of Clark Valley, nine miles from San Luis Obispo by good road.

Bibl: State Mineralogist's Reports XII, p. 330; XV, pp. 689-690; State Mng. Bur. Bull. 76, pp. 69-74. U. S. Geol. Survey San Luis Folio 101. U. S. Geol. Survey Bull. 427.

## MINERAL WATER.

A large number of mineral springs and wells having a wide variety of chemical salts in solution occur in various sections of the county. The better known and most improved springs and resorts are in the southwestern part and in and around Paso Robles. Other springs

are found in the southeastern part and Carrizo Plain.

The direct monetary return from the sale of mineral water in San Luis Obispo County is small. Besides water, there is only one other merchantable product directly due to mineral springs. This is onyx marble, illustrated by the noted Kessler Mexican Onyx (travertine) deposit at Kessler Springs. Nevertheless, the mineral springs indirectly add much to the wealth and prosperity of the county, as the recreational attraction of the resorts and the medicinal qualities of the waters are brought to the notice of an ever-increasing traveling public; and they may properly be considered as one of the county's most valuable mineral resources.

Bitterwater Spring is one of several small springs in the southern part of Carrizo Plain. It is a watering place for live-stock.

Cameta Warm Spring is located 30 miles southeast of Paso Robles. It has a small flow with a temperature of 74° F. and has been used to some extent for bathing.

Grand Central Sulphur Spring is located on property owned by the Frank Sparks Estate near the center of Paso Robles. It is in reality a well 510 feet deep, which has been capped and not utilized in any way for a decade.

R. C. Heaton Well. This well is situated on what was at one time a part of the James property, which included the Paso Robles Springs Hotel site. The tract containing the Heaton well is at 10th and Spring streets and comprises a city block, with the exception of one lot, adjoining the hotel grounds. Grace E. Heaton, Paso Robles, owner.

The well was drilled about 20 years ago and a large flow of mineral water, similar to that at the Hotel Springs, was developed. The well is 230 feet in depth, double cased, and cemented to a depth of 120 feet. The water has a temperature of 106° and is under a heavy hydraulic head. If permitted to flow freely it is estimated that it would run 500,000 gallons per day. There is an eight-room cement bath house, with cement tubs, sunk in the ground, for the owner's and tenants' use, but only a comparatively small part of the flow is utilized. The water is not bottled or sold.

Huer-Huero Springs. There are two groups of mineral springs on the Huer-Huero Ranch, located about 15 miles southeast of Paso Robles and  $1\frac{1}{2}$  and 3 miles south of Creston. They are cold and strongly sulphurated. The flow is small.

Kessler Springs are located at the Kessler Mexican Onyx Deposit and are noted because of the deposit of travertine which has formed about them. The flow is small and has a temperature of about 60° F. The water is not utilized. The 'onyx deposit' is described under the heading 'Onyx Marble.'

Merry Hill Mineral Well is situated on a hill about \( \frac{1}{4} \) mile west of Paso Robles. Mrs. J. H. Pinkert, owner, Box 129, Paso Robles; F. L. Mereker, resident manager, Paso Robles. The well is 170 feet in depth, and does not have a large flow, as it can be pumped down in one-half hour, but it immediately fills again. The water is put up in gallon bottles, as it comes from the well and sold locally. The following analysis was made at the University of California a number of years ago:

g	r./gal.	parts/10,000
Potassium sulphate }	5.39	.93
Sourch Chloride	4.11	.81
Sodium carbonate		.21
Calcium and magnesium carbonate Calcium sulphate	17.52	3.00
Silica		.15
Organic matter and chemicals Combined water	6.13	1.05
Total	35.92	6.15

A Mineral Spring is situated on the right hand side of the road from Paso Robles to Adelaide in Sec. 23, T. 26 S., R. 11 E. It is small, barely flowing at the time of visit; cold; and not utilized. A small amount of gas escapes at the surface of the water.

Municipal Baths Springs, in Paso Robles, is an artesian well 392 feet deep, having a flow reported to be 380,000 gallons per 24 hours. Hot sulphur water issues at a temperature of 108.6° F. and is utilized in a very substantial and well appointed municipal bathing pavilion.

Newsom's Springs are situated  $2\frac{1}{2}$  miles east of Arroyo Grande in T. 32 S. R. 13 E. They have been owned by the Newsom Estate since 1864, and the water, which contains iron, was used by the Indians before that

time for medicinal purposes. According to former reports, the spring yielded about 15 gallons of water a minute at a temperature of 100.5° F. The owner states that there has been a noticeable increase in flow and temperature since the recent Santa Barbara earthquake, but no exact data are available. There are spacious grounds, which contain a small hotel, cottages, and bathing facilities surrounding the spring.

Ontario Springs (formerly Budan Springs). Mrs. E. Budan, San Luis Obispo, owner and manager. This spring is in reality an artesian well brought in during 1908 while boring for oil. The water comes up from a 3-inch pipe and has a temperature of 178° F., considerably higher than any other spring or well in the district. There are tub baths and a large outdoor plunge. The water is markedly sulphurated. Ontario Springs is located on the Coast highway, six miles south of San Luis Obispo, and is a popular swimming and bathing resort.

Paso Robles Hot Springs is one of California's most noted and popular pleasure and health resorts. The property is equipped with a magnificent hotel and bath house, completely equipped for the entertainment of guests and the treatment of ailments for which the mineral waters are recommended. There is a large plunge and varied equipment with skilled operators, who administer hot air and vapor baths, massage, exercises and other treatment to supplement the use of the water. The resort occupies a spacious site in Paso Robles, facing the Coast highway. The so-called main sulphur spring is an artesian well, 640 feet deep with a 10-inch casing, which has an enormous flow of hot sulphurated water. The temperature of the water is 107.6° F. and the flow is stated to be 2,000,000 gallons per day.

Paso Robles Mud Bath Springs are operated under the same management as Paso Robles Hot Springs. The mud baths are situated  $2\frac{1}{2}$ miles north of Paso Robles on the edge of Salinas River. The bath house here is equipped with packing rooms and concrete basins built into the mud springs. There is a constant ebullition of gases and mineral water through the mud. The temperature of the water varies from 104° to 122° F. and it is markedly different in mineral content from that at the Paso Robles Springs proper. Adjacent to the mud baths is a 4-inch well, 140 feet deep, called the Lithium Spring, yielding water having a temperature of 118° F. This water is used for drinking. A natural spring, called the Soda Spring, is situated a few yards away. It has a temperature of 77°. Water from this spring was formerly artificially carbonated and bottled by the Paso Robles Soda Works. The Iron Spring is another small spring with a temperature of 64°, containing a little more iron than the others; utilized for drinking.

Pecho Warm Springs are west of San Luis Obispo in Islay Creek, two miles from the ocean. There are several small springs in the group. One has a temperature of  $95^{\circ}$  F. and another a temperature of  $72^{\circ}$ . They have been known and used locally for many years but are not important.

San Luis Hot Springs (formerly Sycamore Springs). This property is situated six miles south of San Luis Obispo and 4 mile from the Coast highway on the road to Avila. Properly speaking, this is not a spring, the water being obtained from an abandoned well bored for oil.

A large flow of hot sulphur water, having a temperature of 110° F. with a considerable quantity of gas, issues from the well and is utilized for bathing in plunges and tubs. There is a good hotel, cottages and other accommodations for guests located on the shaded grounds of this popular resort. Owned by Truppel and Truppel, San Luis Hot Springs, California.

Santa Ysabel Springs are located four miles southeast of Paso Robles. There are two principal springs, the larger of which has a flow of about 220,000 gallons per day and a temperature of 94° F. The springs are used locally for bathing, but the principal use made of the water is for irrigating the surrounding land.

Sulphur Spring. A spring of warm sulphur water rises near the bank of Tassajero Creek, about two miles west of the Coast highway opposite the foot of Cuesta grade on the Santa Margarita side. It flows about 15 gallons per minute, and is unimproved. Situated on the property of Gustave Renkert.

Bibl: State Mineralogist's Report XV, pp. 690-697; U. S. Geol. Survey Water Supply Paper 338; Anderson, Winslow, M. D., Mineral Springs and Health Resorts of California, 1892.

# ONYX MARBLE.

Onyx is a banded variety of quartz. 'Onyx marble' or Mexican onyx is a variety of calcite, resembling true onyx. Mineralogically, it is either aragonite or travertine. Onyx marble is usually deposited by hot or cold springs or as stalactites in caves. It occurs at a few places in San Luis Obispo County.

Ezra Carpenter donated a sample of pale green onyx marble to the Mining Bureau Museum years ago. The locality from which it came is described as the SE[‡] Sec. 9, T. 32 S., R. 15 E.

Kessler Onyx Marble Deposit. This deposit ranks as one of the largest and finest in the state. There are two patented mining claims surrounded by other land holdings of the Kessler Estate. The deposit is in Secs. 9 and 16, T. 31 S., R. 15 E., five miles north of Musick and about 17 miles northeast of Arroyo Grande. It was opened up in 1890, and during the nineties it is said that more than 1000 tons were shipped out, most of it going to the eastern states. The face of the quarry was 50 feet long, 20 feet high and a thickness of 15 feet of material was exposed. The onyx marble occurs in layers from 1 inch to 8 or 10 inches in thickness, and at one point, 30 inches. It is white, also banded and variegated or sometimes marked with red blotches. Some portions are banded with dark green color. The stone is translucent and takes an excellent polish. Blocks three to six feet square have been taken out and larger ones could be obtained by careful quarrying. No production has been made for many years, but the deposit was recently examined by Los Angeles parties who contemplate reopening it. The property is owned by the Kessler Estate, Anthony Kessler, manager. The surrounding Kessler lands are under lease to Arza Porter, Arroyo Grande, California.

Bibl: State Mining Bur. Bull. 38, pp. 111-112.

#### OIL SHALE.

A belt of oil shale strikes east-west across T. 29 S., R. 10 E. It is well exposed three miles west of Adelaide in the bed of Las Tablas Creek, which cuts across it at right angles. In Secs. 19 and 20 on the property of H. T. Ramage, the shale stratum is practically horizontal, the dip being not over 10°. It shows for one-half mile along the creek, but its thickness at right angles to the bedding plane has not been determined. A sample from a cut about two feet in depth in the creek bed, taken several years ago and sent to the laboratory of the Union Oil Company, is reported to have yielded 81 gallons of 16.5 Baumé gravity oil to the ton. Material taken at some point distant from the creek bed and at greater depth would probably show a higher yield.

## PETROLEUM.

The principal development is along Pismo Creek in the Arroyo Grande oil field, where there are a number of wells producing an average of about nine barrels each per day of 14° Baumé gravity oil.

A great deal of unsuccessful drilling has also been done in the county in the past, notably in the Huasna District, Carrizo Plains and Cuyama Valley. Nevertheless interest is being taken at the present time in prospective territory and the acquisition of new leases is more or less constantly under way. During the past year the following new wells have been reported ready to drill:

E. J. Miley, Lot 11, Rancho San Miguelito.

A. J. Crose, Sec. 34, T. 28 S., R. 13 E.

Henry R. Dabney, T. 27 S., R. 10 E.

Fox and McCoy, Lot 133, T. 27 S., R. 11, Walkin.

Lloyd Tevis, Sec. 12, T. 31 S., R. 21 E.

Livermore and Phelps, Sec. 8, T. 32 S., R. 22 E.

Barneberg Oil Co., T. 32 S., R. 15 E.

Carter Mullaly, Sec. 7, T. 32 S., R. 22 E. E. F. Brittan, Sec. 27, T. 32 S., R. 12 E.

Paso Robles Gas Co., Sec. 19, T. 26 S., R. 12 E.

The geology and oil possibilities of the county are discussed in the publications listed in the bibliography, and oil field development operations are reported in current numbers of 'Summary Operations, California Oil Fields,' issued by the Department of Petroleum and Gas of the State Mining Bureau. The reader is referred to these publications for details regarding this branch of the mineral industry.

Bibl: State Mining Bur. Bull. 69 and Map Folio, 1914; Bull. 89, 1921. U. S. Geol. Survey San Luis Folio 101; XXII Annual Report, Pt. 1; Bull. 621; Bull. 406; Bull. 691.

## PLATINUM.

This metal has been observed in some of the beach sands, but no profit has resulted from attempts to recover it. Logan¹ also states that traces of platinum in peridotite from the Santa Lucia Mountains near Santa Margarita in San Luis Obispo County are reported to have been found in analyses made by Baker and Company.

Bibl: State Mining Bur. Bull. 91, p. 24; Bull. 85, p. 95.

¹ Logan, C. A., Platinum and allied metals in California, 1918.

# QUICKSILVER.

San Luis Obispo is a county of many quicksilver mines but few important producing properties. The first locations were made in 1862, and the period of maximum annual yield was reached in 1876. With two exceptions, all the mines that have produced quicksilver are located in the Santa Lucia Range from San Carpojaro Creek in the northwest corner of the county to the middle of T. 27 S., R. 10 E., a distance of about 30 miles.

At the time of visit in September, 1925, no metal was being produced at any of the properties, but some work was being carried on at two of them and a third was being examined with reopening in view. The quicksilver mines and prospects of the county are described in detail in Bulletin No. 78, 'Quicksilver Resources of California,' (1918) which also contains a geological map showing the principal districts. The data herein are intended to cover only new developments and changes since Bulletin 78 appeared, and detailed descriptions will be omitted. The condition of the industry during the past decade from 1915 to 1925, which includes the 'war period' of high prices and the post-war period of extremely low prices for the metal, is summarized in the following paragraphs:

In 1915 the La Libertad Mine made a small production, using a Johnson-McKay 12-pipe retort. The Cambria Mine was active and produced considerable quicksilver. The Oceanic made a notable output, while the Klau Mine, Josephine and Capitola were not productive.

During 1916 the Klau was equipped with an additional 12-pipe retort and some production was made. The Little Bonanza also made a small output. At the Oceanic the Scott furnaces were in operation, and a good production was recorded, but in October it was closed down. The Cambria Mine was shut down indefinitely in August. There was no activity at the Rinconada.

In 1917 the Deer Trail Mine, a new property, produced some metal, using a 12-pipe retort. The Little Bonanza and Josephine also made a small output. Early in the year the Klau was producing from retorts, but it closed down in a short time. The Oceanic was the most productive and the only property in the county operating at the end of 1917.

The Oceanic was likewise the only producing quicksilver mine in 1918 but one of its two 50-ton Scott furnaces was out of commission at the end of the year.

During 1919 operations were continued at the Oceanic with one 50-ton furnace in operation. The Klau Mine was reopened late in the year by the Carson Quicksilver Mining Co. Lessees on the Little Bonanza made a small output.

In 1920 the Oceanic ran until the end of October when the whole plant was closed down. The Klau also closed down, and there was no

active property in the county by the end of the year.

None of the San Luis Obispo County mines were producers in 1921. During 1922 the reduction plant at the Rinconada was overhauled, and two trial runs made in November. The Klau and Oceanic remained idle.

With the exception of a few flasks recovered from the rotary fur-

nace at the Rinconada Mine, none of the properties in the county were productive during the year 1923.

In 1924 there was a small output, which came from the Klau Mine where ore recovered in development work was treated in retorts. The Rinconada, Oceanic and other properties were idle.

Benton Ranch Deposit (Lehman Mine). This property is located in Sec. 13, T. 27 S., R. 9 E., 12 miles from Cambria. Now owned by A. F. Barton, Cambria, California. Idle.

Bibl: State Mineralogist's Report XV, p. 711; State Mining Bur. Bull. 27, p. 161; Bull. 78, p. 127.

Cambria Mine (formerly the Bank Mine). This property, in Sec. 36, T. 26 S., R. 8 E., made a good reputation as a quicksilver producer between 1905 and 1908. It was active thereafter, but was shut down for an indefinite period in August, 1916, development work having failed to locate an orebody, and it is probable that the Cambria Mine will never again be worked. The property is reported to be controlled by Earl Frazier, Ocean Park, California.

Bibl: State Mineralogist's Report XV, pp. 700-705; State Mining Bur. Bull. 27, p. 154; Bull. 78, pp. 128-131.

Capitola Mine and Santa Monica Claim were locations adjoining and covering extensions of the orebodies worked in the Klau Mine. They were abandoned by the original locators and later were taken up by interests connected with the Klau Mine and are now held in conjunction with it.

Bibl: State Mineralogist's Report XV, p. 705; State Mining Bur. Bull. 78, pp. 131–132.

Claus Group, see Rinconada Mine.

Cypress Mountain Group. This property consists of 160 acres of patented land in Secs. 1 and 2, T. 27 S., R. 9 E. Owned by Mrs. W. S. Forrington, Paso Robles, California. Idle.

Bibl: State Mineralogist's Report XV, p. 706; State Mining Bur. Bull. 27, p. 156; Bull. 78, p. 132.

Deer Trail Mine. Property consists of two claims and a millsite located in Sec. 32, T. 32 S., R. 16 E., and owned by H. H. Carpenter, John W. Adams, and Wm. Arebalo, of San Luis Obispo. This is one of the mines mentioned in the introductory paragraph as being located entirely away from the main quicksilver producing area, which is in the northwestern portion of the county. The Deer Trail is about seven miles east of Huasna post office and 20 miles from Arroyo Grande. The claims were located in 1915. It was equipped with a 12-pipe retort and about 70 flasks of quicksilver were produced before mining ceased. The claims cover a series of narrow calcite veins striking east across a low ridge trending north-south. The country rock is a metamorphic sandstone. The cinnabar occurs in knife-blade seams and vugs in the more or less breceiated calcite veins.

There is an upper tunnel, 80 feet in length, on the principal mineralized vein. A second tunnel about 50 feet lower was driven in on

this vein and from this level the ore shoot was underhand-stoped to a depth of 40 feet and for a width of four to six feet. A third tunnel lower down connects with the bottom of this stope and from this tunnel level a winze was put down about 30 feet, which is said to be in ore at the bottom though the vein is narrow at this point. A fourth tunnel was started still lower down the hill to cut the orebody at a considerably lower depth, but it would have to be run several hundred feet to get under the ore shoot developed above, and the work was discontinued soon after starting it. Similar parallel calcite vein systems, both north and south of the main working, also show cinnabar, and they have been prospected a little in doing assessment work, which is being kept up. The production has been fair for the amount of work done, and it is quite possible that it may again be a producer.

All ore taken out was retorted in a 12-pipe bank now in poor condition and which would require repairing or rebuilding to make it usable. Water was obtained by pumping from a spring about one-quarter mile

from the mine.

Bibl: State Mining Bur. Bull. 78, p. 133.

Doty Group. Holdings comprise five unpatented claims in Sec. 14, T. 26 S., R. 8 E. There have been no noteworthy changes at this property. Doty Brothers, owners, Cambria.

Bibl: State Mineralogist's Report XV, pp.706,719; State Mining Bur. Bull. 27, pp. 156, 165; Bull. 78, p. 133.

Elizabeth and Winona Group. Comprises two locations in Sec. 17, T. 27 S., R. 10 E. Idle. Owned by Mrs. Elizabeth Bagby, Adelaide.

Bibl: State Mineralogist's Report XV, p. 707; State Mining Bur. Bull. 27, p. 157; Bull. 78, p. 133.

Josephine Group (also Tartaglia Group or George Mine). Consists of two claims in Sec. 29, T. 27 S., R. 10 E. There have been no new developments at this property. Owned by Mrs. Elizabeth Bagby, Adelaide.

Bibl: State Mineralogist's Report XV, p. 720; State Mining Bur. Bull. 27, p. 157; Bull. 78, p. 134.

Keystone Mine. This mine is on patented land in Sec. 13, T. 26 S., R. 8 E., and is owned by Phelan Brothers, Cambria. It was a producer during the seventies, but has not been active in recent years.

Bibl: State Mineralogist's Reports X, p. 581; XV, pp. 113-114; State Mining Bur. Bull. 78, pp. 134-135; U. S. Min. Resources West of the Rocky Mountains, 1875, p. 14.

Kismet Group. Three claims in Sec. 7, T. 27 S., R. 10 E. Idle.

Bibl: State Mineralogist's Report XV, p. 114; State Mining Bur. Bull. 27, p. 159; Bull. 78, p. 135.

Klau Mine (also sometimes known as Sunderland, Santa Cruz, Karl, Sierra Morena, or Carson Mine). This property in Sec. 33, T. 26 S., R. 10 E., is the principal mine in the Adelaide district, and one of the

largest and most developed quicksilver properties in the county. It was originally discovered in 1868 and has been an intermittent producer ever since. In 1902 it was the fourth largest producer in the state.

The history of the mine and a detailed description is contained in Bulletin No. 78, issued in 1918. Since the publication of the above report, the property has been acquired by the present owners, the Carson Quicksilver Mining Co., a Delaware corporation; home office, Wilmington, Delaware; Ellard W. Carson, manager, San Luis Obispo.

Development work since the last report has demonstrated the existence of three principal 'veins' or lines of ore shoots in the wide mineralized zone running through the property, instead of two noted in the earlier report. The writer's attention was also called to an apparent error in the former description where it was stated: "Both these ledges are developed by the 60° inclined shaft sunk, it is stated, to a depth of 800', but a large amount of drifting and crosscutting failed to reveal workable ore on the lower levels. These workings became so extensive that a raise to the surface for ventilation was required, and in the course of driving it the best orebody found in the mine was uncovered." Mr. Carson states that the 60° inclined shaft only reached a depth of 100 feet vertical, instead of 800 feet, and that the valuable orebody referred to was discovered between the main level and the surface. These old workings are now largely caved and inaccessible.

The nature of most quicksilver orebodies and the instability of the metal market have discouraged exploitation on a large scale, but the present price of around \$84 per flask for quicksilver and the possibilities held out by the wet method of recovery, using alkaline solutions, have developed a renewed interest in this branch of mining.

The Klau Mine was recently examined, with reopening of the property in view, and it is probable that it will soon again be on the active list.

Bibl: State Mineralogist's Reports IV, p. 336; X, p. 580, XXI, p. 336; XIII, p. 600; XV, p. 709-711; State Mining Bur. Bull. 27, p. 157; Bull. 78, pp. 135-138. U. S. Geol. Survey Mon. XIII, p. 382; Min. Res. West of the Rocky Mts., 1875, p. 14; 1876, p. 20. Mining and Sci. Press, Nov. 12, 1904.

La Libertad Mine. This mine is in Sec. 21, T. 27 S., R. 10 E., in the Adelaide district, and was operated for a time during the war years, under lease by the Belt Quicksilver Mining Co. It has also been known as the Jacks' Mine. Owner, Mrs. Elizabeth Bagby, Adelaide, California. Idle.

Bibl: State Mineralogist's Report XV, p. 700; State Min. Bur. Bull. 27, p. 159; Bull. 78, p. 138.

Little Bonanza (formerly Josephine; also Alice and Modoc). This is reputed to be the first quicksilver mine worked in San Luis Obispo County. It consists of a patented claim in Sec. 17, T. 27 S., R. 10 E.,

¹ State Mining Bur, Bull, No. 78, page 137,

in the Adelaide district, owned by an eastern estate. Lessees made a small production about 1916, but it has been idle since.

Bibl: State Mineralogist's Reports X, p. 580; XV, p.711; State Mining Bur. Bull. 27, p. 154; Bull. 78, pp. 138–139. Min. Res. W. of Rocky Mts., 1875, p. 14.

Madrone Mine is in Sec. 22, T. 27 S., R. 10 E., adjacent to the La Libertad property. It was a producer about 1900, but the workings are all superficial. Idle. Owner, John Carmine, Cayucos, California.

Bibl: State Mineralogist's Report XV, p. 712; State Mining Bur. Bull. 27, p. 161; Bull. 78, pp. 139-140.

Mahoney Mine (also called Gould or Buena Vista). This is on patented property in Sec. 33, T. 26 S., R. 10 E., lying southeast of the Klau Mine. Owner, Miss Mary I. O'Toole, San Jose. Idle.

Bibl: State Mineralogist's Report XV, p. 712; State Mining Bur. Bull. 27, p. 161; Bull. 78, p. 140.

North Star Mine (Santa Maria). In Sec. 13, T. 25 S., R. 6 E. Idle for years.

Bibl: State Mineralogist's Report XV, p. 712; State Mining Bur. Bull. 27, p. 161; Bull. 78, p. 140.

Oceanic Mine. This well-known quicksilver mine comprises large holdings in Secs. 15 and 21, T. 27 S., R. 9 E., five miles easterly from Cambria on Santa Rosa Creek. The original claims were patented in 1865. Production began in 1876. It has been closed down at various intervals since, due to depressions in the quicksilver mining industry, but it ranks as the largest quicksilver producer in San Luis Obispo County and one of the important mines of the state. It has been extensively developed and well equipped with mining and reduction works; the latter including two 50-ton Scott furnaces.

A detailed history and description of the Oceanic, including a map of the mine workings, is contained in Bulletin No. 78, published in 1918. At that time it was owned by Murray Innes, 217 Kohl Building, San Francisco, and was in active operation. The property continued to produce until the end of October, 1920, when it was closed down. The mine remained idle until July, 1925, when it was taken over by the Metals Exploration Co., 725 Standard Oil Building, San Francisco. Harry Payne Whitney and R. H. Channing are reported to represent the principal financial interests back of this move. The plans of the present operators are to deepen what is known as the new shaft (winze) 200 feet and then drift north to the orebody. If this work develops sufficient ore, the mine will be operated on a large scale, but if the exploratory work outlined fails to uncover an orebody, it is stated that all operations will cease. The sinking of the new shaft (winze from the main tunnel working level) had just begun at the time of visit

(September, 1925). Seventeen men were employed. M. A. Roche, superintendent.

Bibl: State Mineralogist's Reports IV, p. 366; VIII, p. 531; X, p. 580; XII, p. 366; XIII, p. 600; XV, pp. 712–718; State Mining Bur. Bull. 27, pp. 151, 162, 243; Bull. 78, pp. 140–146.
U. S. Geol. Survey Mon. XIII, p. 382; Min. Res. W. of Rocky Mts., 1875, p. 14; 1876, p. 20. A. I. M. E. Bull., Feb. 1915, pp. 497–504; Trans., Vol. LI, pp. 110–119. E. & M. J., Vol. 102, p. 512, 1916.

Pine Mountain Group. These holdings, in Secs. 3, 10, and 11, T. 26 S., R. 8 E., have been idle for years and are now a part of the cattle ranges of the Hearst Estate.

Bibl: State Mineralogist's Reports VIII, p. 531; X, p. 580; XV, p. 718; State Min. Bur. Bull. 27, pp. 163–165; Bull. 78, pp. 146–147.

Polar Star Mine (also called Santa Clara or Black Hawk). Comprises two claims in Sec. 13, T. 25 S., R. 6 E. There were some early operations here between 1870 and 1900. The claims were relocated in 1915. Idle. Last known owner, A. L. Carpenter, San Luis Obispo.

Bibl: State Mineralogist's Reports X, p. 581; XII, p. 366; XV, p. 718; State Min. Bur. Bull. 27, p. 165; Bull. 78, p. 147.

Rinconada Mine (also called San Jose Valley Mine). This property, like the Deer Trail, is quite apart from the main quicksilver belt of the county, which is in the northwestern part; it being situated 11 miles southeast of Santa Margarita. The mine is an old one located in 1872, and was worked by various owners in the past who are said to have produced considerable quicksilver by working the rich surface exposures and outcrops. In 1876 it was equipped with a special sheet-iron type of furnace which did not work well. Later two benches of 10-pipe retorts were put up.

The property includes Quicksilver Claim No. 1, No. 2, Amended No. 5, and Pedraita O, also the right to mine from Lot 2, Sec. 28, T. 30 S., R. 14 E., M. D. M., and two mill-sites, the Tenderfoot and Pedro. Owners,

Cecilia P. and Chas. T. Claus, Santa Margarita.

The mine was leased in September, 1921, to W. B. Ewalt and A. Ledeboer, of Atascadero, who sub-leased to other parties. The mine was equipped with a 4' x 50' rotary furnace, operated by a 20-h.p. Fairbanks-Morse gas engine and other equipment. Two trial runs were made resulting in a small production, but disagreement arose among

the operators and they quit.

The Ewalt and Ledeboer lease was renewed in 1923, and the mine was again sub-leased to the Santa Lucia Mining Corporation, a Delaware corporation, Suite 717, C. C. Chapman Building, Los Angeles, the principals of which are E. E. Peacock, L. E. Jones, John G. Bryson, and S. G. Davis. Some innovations were made in the furnace construction, including an inner tube 18 inches in diameter, but this failed to work mechanically when the furnace became hot, and it had to be torn out. Overhauling, changes and repairs to the reduction plant had occupied attention and was still in progress at the time of visit

(September, 1925), but it was expected that the plant would be ready in two weeks. One miner was employed and four men on top. The country rock is mainly serpentine. There are good-sized croppings of ore, but practically no tonnage developed ahead. Two additional claims, owned by Cecilia P. and Chas. T. Claus, are not included in the property under lease.

Bibl: State Mineralogist's Reports X, p. 581; XII, p. 366; XIII, p. 531; XV, p. 719; State Mining Bur. Bull. 27, p. 166; Bull. 78, pp. 147–148. U. S. Geol. Surv. Mon. XIII, p. 381.

There have been no changes noted at the Sunset View, the Vulture Mine, the Warren Ranch prospect, or the William Tell Mine since they were described in Bulletin No. 78, 1918.

Wittenberg Mine in Sec. 8, T. 27 S., R. 9 E., near the Oceanic, is now owned by Peter Silacci, Cambria, California. Idle.

Bibl: State Mining Bur. Bull. 78, p. 149.

#### SAND AND GRAVEL,

Templeton Sand Plant. This plant was built in 1915. It was originally run by steam power and operated by the California Highway Commission. It is now owned by the Granite Rock Company, of Watsonville, and operated by the Central Supply Company, which has a branch office in San Luis Obispo. The plant is situated on the bank of the Salinas River at Templeton beside the Southern Pacific tracks, on a spur from the main line. A drag-line bucket is used to excavate and raise the sand to the top of the plant where it is dumped, screened and run direct to cars without washing. A 40-h.p. electric motor operates the bucket line. The plant has a maximum capacity of 3 cars per day, and 2 men are required to operate it.

## SODIUM SULPHATE.

Consolidated Chemical Co. This company controls a large acreage comprising the greater part of Soda Lake in Carrizo Plain from which there has come a considerable output of sodium sulphate, known to the trade as 'salt cake.' The company was incorporated in July, 1912, with an authorized capital of \$1,000,000. Ed. Sutter, president; J. C. Long, secretary; home office Dimock Building, Lompoc, California.

Soda Lake is situated in T. 31 S., R. 20 and 21 E., and covers an area of 2800 to 3000 acres. The lake receives the drainage of Carrizo Plain and has no outlet. However, as evaporation in this region exceeds the rainfall, the lake is dry except after heavy storms, and its surface is covered with a layer of white crystalline salts leached from the surrounding formations. The deposit is principally sodium sulphate in the form of the mineral mirabilite (Glauber's salt) with some blödite associated. The surface of the underlying mud is covered with shallow saucer-like depressions and the thickness of the sodium sulphate crust varies from one inch near the circumference of the depressions to six inches at the center. There are also some deep channels that have been filled. According to Gale¹, the available salines amount to not less than 1,000,000 tons.

¹ Gale, Hoyt S., U.S. Geol. Survey Bull. 540, p. 428.

He also gives the following analysis of the material:

	Per cent
Insoluble	0.40
$Al_2O_3$	.04
MgO	
('a()	.45
Na,()	40.50
K ₂ ()	.28
II ₃ ()	
('Õ;	
$SO_3^{}$	46.12
Cl	
	102.37
Less ()	2.09
	100.28

The company erected a plant at the south end of the lake for evaporating the saline water and recovering the solid salt, but operation of the plant has been intermittent. The limited market for 'salt cake' and the long haul of 28 miles to McKittrick, the nearest shipping point, makes exploitation difficult.

The deposit was last worked under lease by the *Pacific Distributing Corporation*, 85 Second street, San Francisco; H. G. Frank, president

and general manager.

This company began operating in February, 1923, and continued

until April, 1925, since which time the plant has been idle.

Much additional machinery was installed at the plant and a total of seven miles of narrow-gauge railroad was built on the lake, over which the crude sodium sulphate was hauled in cars by a gasoline locomotive to the plant. The crude salt was crushed, washed, dried in centrifugals, sacked, and hauled to McKittrick by auto trucks. The plant was operated by electric power, from 80 to 100 horsepower being required. Steam from an oil-fired boiler was also used in processing. During the first year from 40 to 60 tons of sodium sulphate were produced per day, but the output dropped to 20 to 30 tons per day the second year.

The Consolidated Chemical Co. is planning the installation of a more economical system of handling the material before operations are

resumed.

Bibl: State Mineralogist's Reports VIII, p. 532; X, p. 563; XV, p. 127; XVII, p. 386. State Min. Bur. Bull. 24, p. 136. U. S. Geol. Survey Bull. 280, p. 369; Bull. 540, p. 428.

#### STONE INDUSTRY.

#### Rubble and Crushed Rock.

There are no commercial rock crushing plants operating in the county, although in former years a number of plants have been located here.

Southern Pacific Company has a very large quarry and rock-crushing plant for supplying their own needs situated in Calf Canyon about three miles northeast of Santa Margarita. The rock is a coarse-grained granite, which is broken in large blocks for rubble and riprap. There is also a crushing plant containing three large gyratory crushers, secondary crushers, screens, etc., for producing broken rock of various sizes. The plant is on a spur branching from the main line about three miles north of Santa Margarita. It is operated by electric power, but was shut down temporarily at the time of visit, and detailed data were not obtained.

# Building Stone.

Many varieties of stone have been used in the county for building purposes, for curbing, culverts, foundations, and to a small extent for monumental purposes. There are many deposits of suitable rock, but the limited market for such material has caused all former quarries to close down, and there has been no cut stone produced for a decade or more. The most important quarries are listed herein. Descriptions will be found in the reports listed in the bibliography.

Bishop's Peak Quarry. Considerable building stone has come from two quarry openings on the side of Cerro Obispo, just outside of San Luis Obispo.

Caen Quarry. Formerly operated in Sec. 36, T. 32 S., R. 13 E., M. D. M., and in Sec. 26, T. 12 N., R. 35 W., S. B. M.

Lee Quarry, in Sec. 17, T. 30 S., R. 12 E., M. D. M.

Moore Quarry, in Sec. 31, T. 12 N., R. 35 W., S. B. M., near Los Berros.

Morro Rock. Stone was quarried here for the breakwater at Port Harford.

Bibl: State Mineralogist's Report XV, pp. 722-724; State Mining Bur. Bull. 38; U. S. Geol. Survey Folio 101.

#### VOLCANIC ASH.

Francis Cleaner Mine. Owner, M. L. Francis, R. D Box 233, Paso Robles. The Francis property comprises 480 acres of patented land in Secs. 21 and 22, T. 28 S., R. 15 E., M. D. M. There is a large deposit of indurated white volcanic ash interbedded with siliceous shale and sandstone, exposed by creek erosion at several points from ½ to ¼ of a mile apart on the property. Very little work has been done on it, but the stratum of volcanic ash appears to be not less than 20 feet in thickness and of uniform quality wherever exposed. The formations have no appreciable dip. The deposit apparently covers about 25 acres, but there is considerable overburden over most of it. The character of the material was not discovered by the owner until 1923, since which time several tons have been taken out. This was ground at a local feed mill, put up at home by the owner in the form of polishing powder and soap and sold by house-to-house canvassing. Users report it to be very satisfactory, but the owner lacks the capital

to handle it on a large scale. The deposit is at an elevation of 1500 feet and is easily accessible. It is 24 miles by good road from Paso Robles or 16 miles from Santa Margarita, the nearest railroad station, over a road with more grades. A permanent water supply would have to be developed by well, as the creeks are dry except in the rainy season.



#### LOS ANGELES FIELD DIVISION.

W. BURLING TUCKER, Mining Engineer.

#### SANTA BARBARA COUNTY.

#### Introduction.

The area comprising Santa Barbara County was mapped and named in 1602 by the Spanish Expedition, which set out from Mexico under Vizcaino. In 1786 Padre Junipero Serra established the Central Mission of the Franciscan Fathers, where the city of Santa Barbara now stands. The county was created February 18, 1850, and is one of the original twenty-seven counties of the state.

Santa Barbara County consists of 2740 square miles, including the islands of San Miguel, Santa Rosa, and Santa Cruz, which are located twenty miles off the coast. It is bounded on the north by San Luis Obispo County, on the east by Ventura County, on the south by the Santa Barbara Channel, and on the west by the Pacific Ocean.

The population, according to the census of 1920, was 41,097, and is now estimated as over 50,000. The city of Santa Barbara, the county seat, with a population of over 30,000, lies on the shores of the channel. Santa Maria is the second community in Santa Barbara County and has a population of over 5000.

## Topography.

Much of Santa Barbara County is hilly and mountainous; the Santa Ynez, a low range of mountains, follows the trend of the coast across the southern part of the county; and the San Rafael, a higher range, strikes through the center of the county and extends almost to its northern limits. These mountains, with their foothills and spurs, impart to the whole county a rugged and diversified aspect.

The principal valleys are the Santa Maria, Los Alamos, Lompoc, Santa Ynez, and Cuyama valleys. These fertile areas are well adapted for the growing of cereal crops, citrus fruits and cattle raising.

#### Streams.

The principal drainage systems of the county are the Santa Maria and the Santa Ynez rivers. The former is the natural boundary between Santa Barbara and San Luis Obispo counties. It rises in the high mountains in the northwestern part of Ventura County and flows westward, draining the Cuyama and Santa Maria valleys. The Santa Ynez River, flowing west between the Santa Ynez and San Rafael mountains, traverses the entire length of the county. Los Alamos Creek flows westward draining the Los Alamos and San Antonio valleys. These streams constitute the only large streams in the county.

## Water supply.

The city of Santa Barbara secures its water from the Gibraltar Dam on the Santa Ynez River, which impounds a lake several miles long. From this reservoir the water is conducted by a three-mile tunnel through the Santa Ynez range to a distributing station.

## Climate.

The climate of Santa Barbara County is equable throughout the year, the average annual temperature being 60° F. The western

coast region is subject to heavy fogs and strong ocean winds. The southern coast is more sheltered, and fogs occur rarely. The rainfall varies from rather light in the valleys to 20 inches on the coast, this being confined to the winter and spring months.

## Transportation.

The county is traversed by the Southern Pacific Railroad which follows the coast line, with branch lines from Guadaloupe to Betteravia, and from Surf to Lompoc. The Pacific Coast Railroad, a narrowgauge line, runs from Port Harford, in San Luis Obispo County, through Santa Maria to Los Olivos, with branches from Santa Maria to Betteravia and Sisquoc. Santa Maria Valley Railroad connects with the Southern Pacific Railroad west of Santa Maria and runs southeast through the Santa Maria Valley to Leonard.

The coast route of the State Highway enters the county north of Santa Maria, and runs the length of the county, connecting Santa Barbara City with Los Angeles and San Francisco. Different laterals from this highway afford transportation for auto trucks and stages

to interior towns.

## Mineral resources.

Santa Barbara County owes its position of sixth in the state in regard to its mineral output to the presence of productive oil fields within its boundaries. The total value of its mineral production during the year 1923 was \$5,005,782; of this amount the value of natural

gas and petroleum was \$2,567,158.

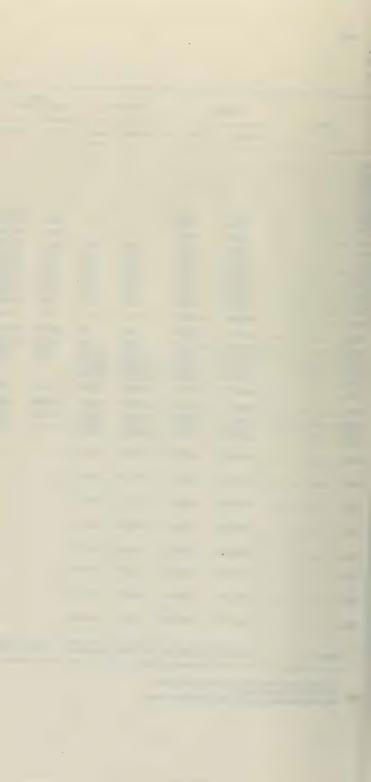
Among its mineral resources both developed and undeveloped are: Asphalt and bituminous rock, barytes, brick, chromite, copper, diatomaceous earth, gilsonite, gold, gypsum, limestone and lime, manganese, mineral water, natural gas, oil shale, petroleum, sandstone and the stone industry. The attached table gives the complete recorded output and value of the minerals of the county from the earliest available record for 1881 to and including 1924.

## SANTA BARBARA COUNTY MINERAL PRODUCTION, 1881-1924.

Year	Petro	leum	Natura	l gas	Asph bitumin		Minera	l water	Diatomaco	eous earth	Bri	ck	Limes	stone	Sands	stone	Miscel- lancous stone ¹ ,	_	Miscellar	neous and unapportioned
	Barrels	Value	M Cubic feet	Value	Tons	Value	Gallons	Value	Tons	Value	M	Value	Tons	Value	Cubic feet	Value	value	Amount	Value	Substance
1881																			\$2,000	Gold.
1889																		***********	41,423 10,293 2,478	Gold. Gold. Gold.
1891 1892 1893																			896	Gold.
1894 1895	1,800 16,904	\$1,800 12,678			4,550 23,950	\$91,000 139,000	22,500	\$3,000								AF00		12 ozs.	4,000	Gold. Platinum.
1896	39,792 130,136	35,813 130,136	³500	\$246	18,430 18,047	317,910 318,000	31,500 65,000	20,300   30,000			100	e700			5,000	\$500			8,592 3,000	Gold, Gold,
1898 1899 1900	132,217 208,370 183,486	112,549 191,228 165,138	*165 150 1,203	135 120 2,966	19,735 6,058 5,270	351,400 121,160 105,500	15,000 15,000 19,000	7,000 5,000 10,350			100 120 4,620	\$700 960 40,960	7,205	\$3,602	224,820	117,260	\$82,662		1,000	Gold.
1901	203,616 230,440 262,226	113,385 181,313 149,640	3876 937 320	438 375 320	4,145 1,259 2,974	55,800 12,590 41,688	113,780 105,280 88,800	60,200 60,200 22,280	362 2,700	\$2,172 15,925	1,250 1,400 4,900	9,825 12,200 46,200	10,00° 20,000	25,000 40,000	72,000 74,200 82,654	27,100 21,500 34,240	33,400 4,395	30,000 bbls.	200 30,000	Gold. Lime.
1903 1904 1905	790,000 3,534,000	445,560 1,413,600	3,000	1,500	9,000 3,000	190,000	118,000	18,249 21,450	6,950 3,000	112,282 15,000	1,120 4,025	8,420 34,750	6,000 5,000	12,000 7,500	5,000 29,600	3,600 18,330	57,792	52 flasks	2,070	Quicksilver.
1906	4,876,000	1,237,250	1,000	500	25,000	250,000	13,750	10,450	2,300	13,800	200	1,600	8,000	16 000	36,195	25,230	9,732	}	725 2 250	Gold. Silver. Gold.
1907	8,392,623 8,847.589 8,116,788	4,166,661 4,423,794 4,069,661	715,612 768,000	300 357,806 394,621	19,192 7,000 200	258,549 70,000 2,488	39,480 5,500 155,400	24,250 4,932 22,200	2,531 2,950	28,948 32,012	1,615 750 990	14,650 7,500 9,180	15,000 16,580 4,849	30,000 33,160 6,619	39,740 10,525 31,120	37,566 6,545 10,648	4,950 10,930 5,316	60 flasks	2,289	Quicksilver, Unapportioned, 1900-1909,
1909 1910 1911	7,682,555 6,766,156	3,856,222 3,204,717	9,198,000	1,393,250 100,386		2,100	155,000 73,640	21,500 15,900	1,343 1,344	14,117 13,720	1,900 1,600	16,825 13,800	4,028 4,239	7,898 8,174	39,720 58,976	15,888 29,507	6,035 6,602	70 flasks 50 flasks	3,225 2,301	Quicksilver. Quicksilver.
1912	6,862,719	3,747,045	*3,425,000	253,633	11,120	5 556	105,000	11,550	1,129	13,074	2,615	17,150	5,327	11,666	4,500	1,670	17,480	12,000 tons 17,500 bbls. 12,000 tons	16,000 16,434 16,000	Clay. Lime. Clay.
1914	6,291,076 4,325,787 5,634,534	3,151,725 1,989,862 3,442,700	5,096,300 6,313,380 3,193,368	254,815 378,802 279,697	10,000 25.000	10,000 50,000	112,500 160,400 189,026	108,130 152,432	6,895	28,960	3,000 2,100 1,800	24,000 16,800 14,400	5,884 6,157 5,956	19,623 11,263 10,006	4,500 9,286 29,900	1,670 1,850 6,488	11,450 15,300 13,900	26,512 bbls.	25,910 70,000 61,600	Lime. Other minerals. Other minerals.
1915	4,502,206	3,574,752	3,660,140	724,746	2		176,608	156,175 110,200	2		1,000	14,400	\$	10,000	3,520	1,017	12,395		111,919	Bituminous rock, brick, 'granite,' diatoma- ceous earth, limestone, quicksilver.
1917	5,631,563	4,550,303	3,104,170	227,507			104,991	86,026	2		3		1		28,700	6,150	5,950	97 tons	126,830 150,315	Potash.  Brick, diatomaceous earth, limestone, quicksilver.
1918	7,334,104	9,057,618	4,150,316	338,036	2		73,117	97,162	2		2		3,790	18,830	2		11,613	{ 1,863 tons	256,780 271,792	Potash. Bituminous rock, chromite, brick, diatoma-
1919	6,089,082	6,850,217	4,084,709	336,092	3		82,147	81,041	2		2		1				29,900	298 tons	30,128 267,539	ceous earth, quieksilver, sandstone. Potash. Bituminous rock, chromite, brick, diatoma-
1920	5,803,583	9,140,643	1,359,665	128,126	2		95,843	110,931	1		3				1		27,436	{ 410 tons	40,000 1,091,475	ceous earth, limestone. Potash. Bituminous rock, brick, diatomaceous
1921	5,465 942	9,122,657	1,544,892	145,179	2		97,847	133,590	2		 	 			2		65,600	( 143 tons	5,720	earth, quicksilver, sandstone. Potash.
1922	3,931,155	3,974,398	1,876,900	167,290	2		110,552	52,269	2		3				2		72,300		718,183	Bituminous rock, diatomaceous earth sandstone. Bituminous rock, brick, diatomaceous
1923	3,061,947	2,394,443	1,612,287	172,725	2		81,200	80,300	2						2		14,324		2,344,090	earth, potash, sandstone, shale oil.  Bituminous rock, diatomaceous earth,
																				sandstone, shale oil.
1924	2,905,181	3,009,768	1,643,355	158,836	2		2		2		2		2		. 2		75,305		1,915,831	Clay and clay products, bituminous rock. diatomaccous earth, mineral water, shale oil.
Totals	118,253,577	\$87,917,266	52,758,705	\$5,818,447	1213,930	\$2,420,641	2,541,111	\$1,537,067	*31,504	\$290,010	*34,105	\$289,920	2128,015	\$261,341	2789,956	\$366,759	\$594,767		\$8,087,689	



^{*}Includes crushed rock, rubble, rip-rap, sand, gravel. *See under 'Unapportioned.' *Quantity estimated, as only value originally reported.



## METALS.

#### COPPER.

Small deposits of copper ore occur along the southwest slope of the San Rafael Mountains northeast of Los Olivos. The croppings strike east, and may be traced for a distance of about four miles. The ore is azurite, malachite, and chalcopyrite associated with quartz in mineralized shales. A number of claims have been located along these croppings and some development has been done on them, and also on the La Laguna Ranch, but there has been no actual production.

Copper King Mine comprises nine claims located in the San Rafael Mining District, in Sec. 5, T. 7 N., R. 29 W., S. B. M., 12 miles northeast of Los Olivos. Owner, F. B. Montanaro, Los Olivos.

Development consists of a crosscut tunnel about 75 feet in length. The ore is chalcopyrite associated with pyrite in a quartz gangue. Worked for assessment only.

Bibl: State Mineralogist Report XV, p. 735.

Laguna Ranch Mine is owned by the Laguna Ranch Company, W. H. Bradley of Pasadena, secretary. Formerly operated under lease by P. B. Montanaro, Los Olivos. This deposit is on the Laguna Ranch, three miles directly west of the Copper King group of claims.

The ore croppings show azurite and malachite associated with quartz, in a zone of mineralized shales 40 feet wide. The strike of the vein is east, and dip about 45 degrees north. The development consists of two tunnels driven on the vein. Idle.

Bibl: State Mineralogist Report XV, p. 735.

#### GOLD.

Gold and platinum occur in the black sands that are deposited more or less continuously along the beaches, from Pt. Arguello north to the mouth of the Santa Maria River. The most important deposits are  $2\frac{1}{2}$  miles north of Surf, and north of Point Sal. The black sands lie in strata from two to four inches thick, and are covered by layers of beach sand up to several feet thick. A great many attempts have been made to extract the fine gold and platinum from the black sands, and small amounts have been recovered, but so far no successful method has been evolved for the extraction of these precious metals on a commercially profitable scale.

Bear Creek Placer Mine is located along the beach extending from the mouth of Bear Creek to Surf. A. W. Wreske and associates of Anaheim have installed a small test plant at the mouth of Bear Creek, 2½ miles north of Surf, a station on the Southern Pacific Railroad.

The plant consists of a bucket elevator, which elevates the sands from a pit on the beach to a revolving screen. The material from the screen goes to a hopper, from which it is delivered by screw conveyor to a belt conveyor, and is then transported to two hoppers.

The sands from the hoppers are washed over amalgam plates, and then over a set of riffles to a tank. Sands from the tank are disposed of by a screw conveyor. The plant is driven by electric power generated by gas engines. The plant was not operating when the property was visited, being shut down for the purpose of installing a pump to raise the sands direct to the hopper, it being the intention to replace the conveyor system of delivering sands above the plates. The black sands at this point are in strata one-half inch to four inches thick, overlain by layers of beach sand from one to three feet thick. The black sands are reported to have a value of from \$1.00 to \$2.00 in gold, and .01 to .03 ozs. in platinum. Three men are employed.

Bibl: State Mineralogist Reports VIII, p. 537; X, p. 598; XV, p. 736.

#### MANGANESE.

Manganese occurs on the southwest slope of the San Rafael Mountains, ten miles northeast of Los Olivos.

Laguna Ranch Deposits. Several outcrops of manganese occur on the Laguna Ranch, ten miles northeast of Los Olivos, and two miles north of the Cavanaugh Ranch. The property is owned by the Laguna Ranch Company, W. H. Bradley, secretary, Pasadena, California. A number of small lenses of jasper, heavily stained with manganese oxides, outcrop on a ridge northeast of Figueroa Canyon. These lenses strike east, but are small in extent. A sample of ore taken from one of the outcrops is said to have assayed 70% MnO₂, and 12.35% silica.

Bibl: State Mining Bureau Bulletin No. 76, p. 75.

#### PLATINUM.

Platinum occurs with gold in the black sands that are deposited along the beaches near Surf and north of Point Sal. Some platinum has been taken from these deposits.

#### QUICKSILVER.

Commercial deposits of quicksilver occur in Santa Barbara County, in the Santa Ynez Mountains, eight miles north of Santa Barbara, and on the southwest slope of the San Rafael Mountains, twelve miles east of Los Olivos.

Quicksilver was discovered in Santa Barbara County at the Los Prietos Mines, in the Santa Ynez Mountains in 1860. Seven years later, cinnabar was found in Acachuma Canyon, in the San Rafael Mountains. In both of these localities quicksilver has been mined intermittently for many years; but no segregated records of its production previous to 1893 are available. The published records show that from 1893 to 1918, the total production was 263 flasks, valued at \$14,081. At the present writing there is no activity in quicksilver mining in the county, only annual assessment work being done. It is hoped that with the recent increase in the price of the metal, interest in the old mines in these districts will stimulate renewed activity in their development.

Acachuma Mine comprises three patented claims located in Sec. 2, T. 7 N., R. 29 W., S. B. M., 12 miles east of Los Olivos, at the head of Acachuma Creek. Owners are D. D. Davis, Edward Dalton, and the C. Woods Estate of Los Olivos.

The property was formerly worked by the Red Rock Quicksilver Mining Company of Santa Barbara. The orebody consists of mineral-

ized serpentine and shales striking N. 40° W., and dipping 50° E. The vein has a width of about 30 feet. The cinnabar occurs as irregular stringers and pockets of ore along this mineralized belt.

Development consists of seven tunnels totaling over 2,000 feet. The ore was treated in a twelve-pipe retort, two miles below the mine, on Acachuma Creek. A good wagon road runs from Los Olivos to the retort. This property has produced considerable quicksilver, but no accurate production records have been kept. It is said that when the property was operated by the Red Rock Quicksilver Mining Company, the yield was a flask per day.

Bibl: State Mineralogist Reports VIII, p. 537; XV, p. 746; XVII, p. 389; Bull. 27, p. 196; Bull. 78, p. 150; Reg. of Mines, Santa Barbara Co., 1906. U. S. Geol. Surv. Mon. XIII, p. 382.

Los Prietos Mines (includes the Milburn-McAvoy and Snow Groups). These mines are eight miles north of Santa Barbara, in the Santa Ynez Mountains north of the Santa Ynez River. The holdings comprise 29 claims located in Secs. 9, 10, 11, 12, T. 5 N., R. 27 W., S. B. M. Owners, Los Prietos Quicksilver Mines Company, F. M. Townsend, president; Carl S. Milburn, treasurer; Horace

Walley, secretary. Offices, Higgins Building, Los Angeles.

The group of claims is located on a belt of mineralized serpentine which strikes N. 50° W., with a dip 60° to 70° N., and extends along the range for a distance of four miles. The rock formation is sandstone, conglomerate, and shale of the Coast Range, and the strata are folded and faulted in innumerable dips and directions, but have a general easterly strike, and dip to the north. Traversing this belt of sedimentaries is an intrusive belt of serpentine, on either side of which occurs a ledge formation of highly silicified, crushed shale and sandstone, containing cinnabar in variable amounts. Cinnabar is disseminated through the ledge matter, and is said to average about 0.25%. The average lode width is probably not less than 70 feet, but the broken outcrops in many places cover the surface for widths of several hundred feet. The bold yellow-and-brown outcrops stand up prominently from the more eroded inclosing rocks, and are visible for miles. Within this lode occur bodies of cinnabar ore at appreciable distances apart, and three of these ore-areas have so far been partly opened up.

The principal workings are on the Juniper Claim, 800 feet above the river level. These consist of one large and several small opencuts. extending for a length of over 450 feet along the hanging-wall portion of the vein. Tunnels have been driven from three of these open faces, but are partly caved. The main upper crosscut tunnel was in a distance of 100 feet. About 250 feet north and 70 feet below the upper tunnel is another tunnel said to be 100 feet in length. (Caved.) Two hundred and twenty feet west of the main upper tunnel is a tunnel that cut the vein for a distance of 40 feet, showing 20 feet of lowgrade ore.

The Milburn-McAvoy workings on the Santa Ynez group of claims are situated about 2½ miles east of the Los Prietos Mine, and to the south of the river. The vein which is 100 feet wide, and well mineralized with cinnabar, boldly outcrops on the western slope of the ridge, about 800 feet above the river, and can be traced for a distance of 2000 feet.

The principal developments on this group of claims consist of a tunnel 45 feet in length on the Ardell claim. About 50 feet in elevation above this tunnel is a tunnel driven along the vein for a distance of 200 feet, most of the distance being in good ore. About 200 feet above this tunnel, near the crest of the hill, is an opencut which shows a broken face about 50 feet wide. This is the footwall section of the vein, which is over 100 feet wide at this point. The whole exposed face is in ore, and the outerop for a considerable distance is mineralized with cinnabar.

It is said that from samples taken from the different workings on the Santa Ynez group, retort tests on the ore gave 2.3 pounds to 10.5 pounds of mercury per ton; also samples from the Los Prietos Mine workings yielded from 1.2 pounds to 9.4 pounds of mercury per ton. The owners mined and retorted 108 tons of ore, which is said to have yielded an average of 9.2 pounds of mercury per ton during 1918.

A 12-pipe Johnson retort is on the property. With the exception of the annual assessment work, there has been no development since 1918.

Bibl: State Mineralogist Reports VIII, p. 537; X, p. 596; XII, p. 366; XV, pp. 746-748; Bulletin 27, p. 196; Bulletin 78, pp. 150-152. U. S. Geol. Surv. Mon. XIII, p. 382.

## NON-METALS

#### ASPHALT AND BITUMINOUS ROCK.

The county contains many deposits of asphalt and bituminous rock, one of which is being worked on a small scale. The manufacture of asphalt by refining from crude petroleum has entirely replaced its production from natural asphalt and bituminous rock deposits.

The most extensive asphaltum beds in the county are located along the coast line from Carpinteria to Goleta Point, in the Solomon Hills near Graciosa, and on the Rancho La Laguna and Rancho Sisquoc which are south of the Sisquoc River, and east of the town of Sisquoc. Other deposits of minor importance occur in a range of hills lying between the Los Alamos and Santa Ynez rivers, at Point Arguello, near the mouth of Arroyo Hondo, and at other points to Lompoc landing. These deposits have been described in detail in State Mineralogist Reports XIII, pp. 38–42; XV, pp. 730–734.

Higgins Mine is located one mile southeast of Carpinteria Station, between the railroad and the ocean. This is the only deposit that is being worked in the county, being operated only intermittently. The material is being used on the roads in the county. The property was idle when visited. Owner, Mrs. Mary Higgins of Carpinteria. Under lease to A. Sattler and E. P. Stevens of Carpinteria.

The beds of bituminous sands vary in width from 12 to 20 feet, and are overlain by a soft soil overburden four feet thick. It is reported that the material contains from 18% to 20% bitumen.

#### BARYTES.

Eagle Mine comprises four claims located in Secs. 5 and 6, T. 10 N., R. 30 W., S. B. M., 15 miles northeast of Sisquoc, a station on the Pacific Coast Railroad. Owner, Bean Laughlin of Santa Maria.

The deposit is reached by 20 miles of road and trail from Sisquoc. This road follows La Brea Creek through the Sisquoc Ranch, then by trail, a distance of five miles along the North Fork of La Brea Creek. A vein of pure white barytes is exposed for several hundred feet along the top of the ridge above the North Fork of La Brea Creek, at an elevation of 2800 feet. The vein occurs in a tough gray sandstone, strikes east with the trend of the ridge, and dips steeply north. The vein, where exposed, shows an average width of 25 feet. The barite is pure white in color, and samples are said to have analyzed 97% BaSO₄. The only development consists of annual assessment work.

Bibl: State Mineralogist Report XV, p. 734; R. of M. Santa Barbara Co., 1906.

Montecito Barytes Deposit. Barytes occurs on the ridge west of Cold Springs Canyon, two and one-half miles north of Montecito, a station on the Southern Pacific Railroad. Undeveloped.

#### CHROMITE.

Chromic iron ore occurs in Santa Barbara in the serpentine areas along the hills southwest of Point Sal, and on the southwest slope of the San Rafael Mountains. The only commercial deposits that have

as yet been developed are located 12 to 15 miles northeast of Los Olivos. During 1918 considerable tonnage of chrome ore was mined and shipped from this region.

La Laguna Ranch Chrome Deposit. The deposit is situated in the San Rafael Mountain Range, on the ridge between Figueroa and Coralles Creek at an elevation of 2500 feet. It lies on the north corner of the Laguna Ranch, 12 miles northeast of Los Olivos. Owner, Laguna Ranch Company; W. H. Bradley, secretary; Pasadena, California.

Lenses of chrome ore that occurred in the serpentine belt were mined by O'Donnell & Burns Mining Company during 1918. Idle.

Bibl: State Mineralogist Report XVII, p. 387; Bull. 76, p. 179.

Los Olivos Deposit is located 16 miles northeast of Los Olivos, about one-fourth of a mile north of the Happy Canyon and Acachuma wagon road. Considerable float chrome occurs in this area, and several small lenses of chrome iron were extracted a number of years ago.

O'Donnell & Burns Mining Company of San Francisco, during the early part of 1918 discovered some large lenses of high-grade chromite in T. 8 N., R. 29 & 30 W., S. B. M., northeast of the Laguna Ranch, on government land. These deposits are located 15 miles northeast of Los Olivos. A considerable tonnage of ore was mined and shipped from these deposits in 1918. The ore shipped is said to have carried 45%  $\rm Cr_2O_3$ , and some of the cars averaged as high as 53%  $\rm Cr_2O_3$ . It is reported that one lens of ore yielded 265 tons averaging better than 45%  $\rm Cr_2O_3$ . Developments consist of opencuts and short tunnels. Idle.

#### CLAY.

Deposits of clay in Santa Barbara County are limited in extent, being mostly low-grade clays suitable for the manufacture of common brick and tile.

One mile south of Carpinteria are extensive beds of diatomaceous and clay shales, which strike N. 70° W. and dip 70° S. The total thickness of these shales is about 200 feet. The Carpinteria Clay Products Company is using this material for the manufacture of brick and tile.

A deposit of montmorillonite occurs on the property of the Carpinteria Clay Products Company. A bed of montmorillonite eight feet thick has been exposed on the north end of the clay pit. It strikes east, and dips 75° south. The Refineries Clay Company of Los Angeles formerly had a lease on the deposit. A tunnel was driven 300 feet west on the bed, and considerable tonnage mined and shipped to Los Angeles for use in oil refineries for the refining of petroleum products. It is said that 150 cars of material was shipped in 1924. Montmorillonite (hydrous aluminum silicate) is a colloidal clay, sometimes called 'rock soap' or otaylite, on account of being found and mined near Otay, San Diego County. It is white, brown, and red in color, and contains a large amount of combined water.

Carpinteria Clay Products Company deposit and plant is located west of the Coast Highway, 14 miles north of Ventura, and four miles south of Carpinteria. The deposit is located on the ranch of L. L.

Brentner of Carpinteria, ten acres being under lease to the Santa Barbara Builders' Supply Company of Santa Barbara; J. Y. Parker, president; H. H. Young, secretary. Offices, Central Building, Santa Barbara.

The clay beds are nearly vertical, strike east, and have a total thickness of over 200 feet. The clay bank has been opened up for 100 feet in width, and about 75 to 100 feet in height above the floor of the pit. The clay from the opencut is delivered to the plant by means of a dragline scraper, driven by a gasoline tractor.

The material from the hopper goes to a knife-blade crusher, and is then elevated to a 20-mesh revolving screen, oversize being returned to the crusher, and through-size going to a 14-foot pug-mill. It is then sent to a 12" auger press. From the auger press it is sent to a wire-cutting brick machine, which has a capacity of 45,000 bricks per 8-hour day. The brick are dried in trays, mostly in the open. Brick and tile are burned in oil-fired field kilns. The total electric power required to operate the plant is 170 horsepower. Other equipment consists of an 80-h.p. boiler and drying sheds. Fifteen men are employed. The products consist of common brick and building tile, varying in color from light cream to pink.

Parker Brick Company's plant is located on West Montecito street, Santa Barbara, one-half mile west of the Southern Pacific Railroad tracks. Owners, Santa Barbara Builders' Supply Company, J. Y. Parker, president; H. H. Young, secretary. Offices, Central Building, Santa Barbara.

The deposit is a yellowish, sandy clay, and a very plastic black adobe clay. The yellowish sandy clay is obtained from an opencut on a hill west of the plant, and the black adobe from a pit across the road. The clay from these two openings is mixed in variable quantities in order to prevent cracking from shrinkage. The wet process is used, the green brick being dried under sheds in the open. They are fired in oil-fired field kilns. The brick-making equipment consists of a pugmill and a press. The products are common red brick, hollow building tile, and drain tile. Twelve to fifteen men are employed.

Toro Canyon Brick and Tile Company's plant is located in Toro Canyon, near Montecito. Owners, Santa Barbara Builders' Supply Company, J. Y. Parker, president; H. H. Young, secretary. Offices, Central Building, Santa Barbara.

The deposit is a uniform plastic adobe clay, intermingled with blocks of soft yellow standstone. The clay is mined by Fordson tractors from a shallow side-hill opencut. The brick are dried under sheds, or in the open, and fired in open field kilns. Brick-making equipment consists of a pug-mill and a press. Products are common red brick, red roofing tile, and hollow building tile. Ten men are employed.

### DIATOMACEOUS EARTH.

Extensive deposits of diatomaceous earth are located in the foothills along the coast line of Santa Barbara County, extending from Goleta to the Santa Ynez River. The deposits of this material in the vicinity of Lompoc are said to be the most extensive and the purest found in the state. Those that are at present being worked on a commercial  $\frac{10-42102}{10-42102}$ 

scale are located east of San Miguelito Canyon, in the foothills of the Santa Ynez Range. Practically 90% of the output in California comes from Santa Barbara County. These deposits have been thoroughly described by Ralph Arnold and Robert Anderson in U. S. Geological Survey Bulletin 315, 'Diatomaceous Deposits of Northern Santa Barbara County.' The exposures of this material in the hills south of Surf, and along the coast near Goleta, are not as pure as the deposits in the vicinity of Lompoc, and therefore have not been developed to any extent. Diatomaceous earths are very light and extremely porous, chalk-like materials, composed of pure silica, which have been laid down under water, and consist of the remains of microscopic infusoria and diatoms.

The principal commercial use of this material is as an absorbent. It is also employed in the manufacture of scouring soap and polishing powders, for filtration purposes, in making all classes of refractory brick, and as an insulating medium both in heating and refrigeration. It is a first-class nonconductor of heat where high temperatures are employed, such as around steel and gas plants, and power houses. As a nonconductor of heat it has been used alone, or with other materials as a covering for boilers, steam pipes, and safes, and in fire-proof cements. It is also used largely by paint manufacturers as a wood filler.

Celite Products Company (formerly known as Keiselguhr Company of America). Offices, 1135 Van Nuys Building, Los Angeles. August Fitger, president; E. W. Birdseys, secretary; Harry S. Thatcher, general manager.

This company owns approximately 2200 acres located on the Rancho Mission Viejo de la Purisima, in T. 6 N., R. 34 W., S. B. M., in the Lompoc Hills, east of San Miguelito Canyon, two miles southeast of Lompoc. The company owns the most extensive deposits of diatomaceous earth in the district, and is the largest producer in California.

Extensive beds of soft, white diatomaceous earth in a very pure state, varying from thinly-bedded to massive, form a capping over the hills. These beds overlay hard brown siliceous shales, are conformable with them, and strike east, dipping 30° south. Approximately 30 quarries have been opened up on the property, at points where the overburden is light.

The character of the material in different parts of the beds varies, and certain parts of the beds are used for specific purposes. The overburden is first removed, and the diatomaceous earth is quarried by means of special channeling machines developed by the company for

the purpose.

The largest portion of the product is used for insulating brick, which are sawed on the ground from blocks cut by channeling machines. The material used for grinding is cut by channeling machines, and is then quarried and hauled in wagons to the drying yards. After being sun-dried to reduce the moisture content to about 5 per cent, the material is hauled by motor trucks to the mill at White Hills. The sun-dried brick are hauled to a railroad, which connects the property with the Lompoc Branch of the Southern Pacific Railroad, where the company's warehouses are located. Five hundred men are employed.

Bibl: State Mineralogist Report XV, pp. 737-738; Bull. 38, pp. 293-296. U. S. Bur. of Mines Repts. of Investigations, Serial No. 2431; Rock Products, Vol. XXVI No. 25, Dec. 15, 1923; Cement, Mill and Quarry, Vol. XXII, No. 9, May 5, 1923; A. I. M. E. Bull. 104, Aug. 1915, pp. 1539-1550; E. and M. J. P., Vol. 115, June 30, 1923, pp. 1152-1164. For full detail of the keiselguhr industry see 'Metallurgical and Chemical Engineering,' Vol. XII, No. 2, p. 109.

Featherstone Insulation Company's offices, 611 E. Fourth Street, Los Angeles. Robert Burhous, president; J. C. Specht, vice president; R. W. Cole, secretary; H. T. Carlton, superintendent.

This company owns 1500 acres on the Salsipuedes Ranch, three miles southeast of Lompoc. This deposit of pure white diatomaceous



Beds of Diatomaceous Earth, No. 1 Quarry, Featherstone Insulation Company, Lompoc, Santa Barbara County.

carth, from thin-bedded to massive, occurs in a low range of hills west of the Salsipuedes Creek, and adjoins the property of the Celite Products Company on the east. This property was recently acquired by the company from the Hollister Estate Company of Santa Barbara, and has been under continuous development for the past year.

The bed of diatomaceous earth strikes east, and has an average dip of 30° south. Exposures on the west end of the deposit indicate that the bed is over 300 feet thick. The beds of diatomaceous earth overlie hard brown siliceous shales and are conformable with them. At No. 1 quarry, which is located near the top of the ridge, at an elevation of \$20 feet, the strata have been exposed by opencut, showing 12 feet of what is termed No. 1 stratum of filtration material; then two feet of flint; then seven feet of good filtration earth; below this stratum is 25 feet of insulation material. Four quarries have been opened up along the strata on different parts of the property. The character of the material varies in different parts of the beds. Only selected areas where the overburden is light are quarried. Also parts of the bed are

mined according to whether insulation or filtration material is desired. After cleaning off the overburden, the material is quarried by pick and shovel, and loaded into wagons to be hauled to drying yards. At the present writing the blocks are piled along the sides of the roads

for sun drying.

The diatomaceous earth, when quarried, contains about 40% moisture, and after being sun-dried for six weeks, contains about 10% moisture. The dried diatomaceous earth runs 100 cubic feet per ton. Five men are employed getting out insulation material for shipment to the company's plant at Covina. The material is hauled from the deposit by auto truck to Lompoc. The company proposes to install a grinding plant on bottom land near the Las Cruces road, about one-quarter mile from the deposit.

Bibl: State Mineralogist Report XVIII, pp. 366-367.



Beds of Diatomaceous Earth, No. 2 Quarry, Featherstone Insulation Company's Deposit, Lompoc, Santa Barbara County.

Guerra Deposit is located five miles east of Lompoc, on the Santa Rita Ranch. Owner, James Guerra of Lompoc. Extensive exposures of flaky white diatomaceous shales occur in the Santa Rita Hills north of the Santa Ynez River.

Bibl: State Mineralogist Report XV, p. 737; Bulletin 38, p. 295.

La Salle Canyon Deposit. This deposit of diatomaceous earth is located on the ridge east of La Salle Canyon, on Tract No. 79 of Lompoc Rancho, three-quarters of a mile south of La Salle, a station on the Lompoc Branch of the Southern Pacific Railroad. Owner, J. P. Donavan of Lompoc. The deposit was formerly worked by the Silica Products Company of Stockton, California.

The beds of diatomaceous earth strike east and dip 65° north. They occur between sandstone and shale, and are about 300 feet thick. About 250 feet above the floor of the canyon, the beds are

exposed by a cut 300 feet across the face of the deposit, and 75 feet below the outcrop. Considerable tonnage for insulation material has been mined from the quarry. The material was loaded into cars, then dumped into a two-compartment incline chute. From this chute it was loaded into trucks and hauled to La Salle Station for shipment.



Exposure of Diatomaceous Earth on La Salle Canyon Deposit, La Salle, Santa Barbara County.

The property was under production during 1923 and 1924, but idle at the time of visit.

More Ranch Deposit. John F. More of Goleta, owner. Beds of diatomaceous earth, striking N. 25° E., and dipping 45° to 50° NW.,

are exposed along the coast at More's Landing, two miles south of Goleta. This deposit has not been developed, and the material is not as pure as that of the Lompoc deposits.

Salsipuedes Ranch Deposit is owned by the Hollister Estate Company of Santa Barbara. An undeveloped deposit of white diatomaceous earth occurs on the Salsipuedes Ranch, three miles south of Lompoc. Diatomaceous earth occurs as a capping on the low hills east of the Salsipuedes Creek and the Santa Ynez River. The deposit is not as extensive as that being worked on the same ranch by the Featherstone Insulation Company. Undeveloped.

Sykes Ranch Deposit is located on Lots 155 and 158 of the Lompoc Rancho, one-half mile east of Honda, a station on the Southern Pacific Railroad. Richard Sykes of Montecito, owner. Beds of diatomaceous earth cap a low rounded hill, about one-half mile east of Honda. These beds, which are quite extensive, strike east and dip flatly to the north. The deposit is composed of flaky white diatomaceous earth, and is very uniform in character. Diatomaceous shales are exposed along the coast east of this deposit, and are probably a continuation of the same beds, but do not appear to be of as good quality.

Bibl: State Mineralogist Report XV, p. 738.

Sunnyside Mine is located two miles southeast of Lompoc in a side canyon of San Miguelito Creek, and adjoins the property of the Celite Products Company. Mrs. J. Telford Prewitt of Santa Monica, owner. The deposit occurs along the same beds of diatomaceous earth that are being worked by the Celite Products Company. Considerable development has been done on the property, and some tonnage produced, but now idle.

Bibl: State Mineralogist Report XV, p. 738; Bulletin 38, p. 296.

#### GYPSUM.

Point Sal Deposit. A deposit of pure white gypsum occurs on the Casmalia Rancho, one-half mile southeast of Point Sal Landing, and five miles northwest of Casmalia. The beds of gypsum occur in clay. The deposit was worked in the early eighties, and a considerable tonnage produced. All workings are caved. Idle.

Santa Barbara Canyon Deposit. A deposit of pure white gypsum occurs on the east side of Santa Barbara Canyon, five miles south of Quartel P. O. in the Cuyama Valley. The outcrop of gypsum is said to be quite extensive, but is inaccessible, being fifty miles from the nearest railroad.

Bibl: State Mineralogist Report XV, p. 737; Bull. 38, p. 288.

## LIMESTONE.

J. C. Lind of Lompoc owns a deposit of limestone on the south side of San Miguelito Canyon, six miles southwest of Lompoc, opposite the San Miguelito Canyon deposit. Undeveloped.

Bibl: State Mineralogist Report XV, p. 739; Bull. 38, p. 80.

Thomas W. Moore of Santa Barbara owns a deposit on the Las Positas Ranch, three miles west of Santa Barbara. Tests show this limestone to be of no commercial value, though it is said that the cement used in the construction of the Mission Santa Barbara was made from this limestone.

Bibl: State Mineralogist Report XV, p. 739; Bull. 38, p. 80.

Moraga Ranch Deposit is located in Sec. 4, T. 6 N., R. 20 W., S. B. M., and consists of a fine-grained white limestone which outcrops along a hill in upper Mono Canyon. Years ago some development work was done by the Lomo Blanco Lithographic Stone Company of Los Angeles, but the limestone was found to be unfit for lithographic work, due to the presence of numerous small siliceous veins. Abandoned.

Bibl: State Mineralogist Report XV, p. 739; Bull. 38, p. 80.

San Miguelito Canyon Deposit is located on the north side of San Miguelito Canyon, four miles southwest of Lompoc. Owner, C. S. Larsen, Lompoc. The deposit was formerly operated by the Union Sugar Company of Betteravia. All the commercial limestone has been worked out. Idle.

Bibl: State Mineralogist Report XV, p. 741; Bull. 76, pp. 74-75.

#### MINERAL SPRINGS.

Most of the mineral springs in Santa Barbara County are to be found on the southern slopes of the Santa Ynez Range of mountains. These have been a source of considerable wealth for the county. Practically all the waters produced are marketed for medicinal purposes, as they are said to have great value in the eradication and alleviation of many chronic diseases. These waters compare favorably with some of the best curative waters of Europe.

Burton Mound Sulphur Springs. A number of small sulphur springs, which are visible at low tide, issue from the sands along the beach at Santa Barbara. A large sulphur spring of this group occurs on the site formerly occupied by the Hotel Potter, and the water was utilized in the hotel lobby, but owing to the objectionable odor, the pipe leading from the spring has been sealed for a number of years.

Bibl: State Mineralogist Reports XIII, p. 517; XV, p. 741; U. S. Geol. Surv. Water Supply Paper 338, p. 277.

Bythenia Springs. Owner, J. M. McNulty, Santa Barbara. These springs are located on the Hope Ranch,  $3\frac{1}{2}$  miles west of Santa Barbara, and one-half mile northwest of Veronica Springs. Approximate yield is one gallon per minute. The water rights are leased to the Santa Barbara Mineral Water Company, Santa Barbara.

#### Analysis.

## By E. W. Hilgard.

Constituents are in grains per U. S. gallon.

Potassium sulphate	2.72
Sodium carbonate	7.27
Magnesium sulphate	1,146.70
Calcium sulphate	111.28
Iron and alumina	1.46
Sodium sulphate	
Sodium chloride	194.47
Magnesian nitrate	
Magnesian carbonate	35.45
Silica	1.64
Total	2,112.10

Bibl: State Mineralogist Report XV, p. 741; U. S. Geol. Surv. Water Supply Paper 338, p. 295.

Las Cruces Hot Springs are situated on the Las Cruces Ranch, four miles north of Gaviota Station. Owner, the Hollister Estate Company, Santa Barbara. Four sulphuretted springs ranging in temperature from 67° to 97° F. furnish about 50 gallons of water per minute. This water is piped to the ranch houses for local use.

Bibl: State Mineralogist Reports XIII, p. 345; XV, p. 741. U. S. Geol. Surv. Water Supply Paper 338, p. 68.

Montecito Hot Springs consist of 11 slightly sulphuretted springs which issue from seams in thick bedded sandstone in the steep slopes of the Santa Ynez Mountains, five miles northeast of Santa Barbara. These springs range in temperature from 110° to 120° F., and have a total yield of about 50 gallons per minute. Elevation 1500 feet. Formerly a small resort was conducted on this property, but it is now owned by a private club of Montecito residents who use it as a summer camp. Some of this water is piped to the homes of Montecito residents.

Analysis of water from main spring. Analyst, Winslow Anderson (1888). Constituents are in parts per million.

By weight         Sodium (Na)       110         Potassium (K)       Trace         Calcium (Ca)       30         Magnesium (Mg)       27         Aluminum (Al)       7.9         Hydrogen (H)       Trace	Reacting values 4.80 Trace 1.52 2.20 .87 Trace
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	.51 .70 Trace .67
Total626.9	,

Bibl: State Mineralogist Reports XII, p. 345; XV, p. 742. U. S. Geol. Surv. Water Supply Paper 338, p. 66.

Moore Spring issues from a soft clay deposit below a limestone ledge in the Veronica Valley, four miles west of Santa Barbara. Owner, Thomas W. Moore, Santa Barbara. (See Limestone, T. W. Moore deposit.)

Analysis.

# By Pacific Wassermann Laboratories. Constituents in grains per U. S. gallon.

Transfer to the state of the st	0
Magnesium sulphate	
Calcium sulphate	62.86
Iron and alumina	.35
Sodium sulphate	172.56
Sodium chloride	242.02
Silica	4.26
Sodium nitrate	70.79
Organic and volatile	234.90
Total	1,755.99

Bibl: State Mineralogist Report XV, p. 742.

Pinkham's Santa Barbara Mineral Springs consist of a group of five springs located 2½ miles west of Santa Barbara, on the Hope Ranch. Owner, Pinkham Mineral Springs Company, 1815 Bath Street, Santa Barbara. These springs seep from soft clay shales near the top of a low mesa. Approximately 1500 gallons of this water is bottled yearly.

## Analysis.

## By J. M. Curtis & Sons.

## Constituents are in grains per U. S. gallon.

Potassium sulphate	38.55
Sodium carbonate	8.65
Magnesium sulphate	50.40
Calcium sulphate	32.64
Iron and alumina	2.02
Sodium sulphate	662.34
Sodium chloride	45.42
Magnesian carbonate	90.03
Silica	.87
Lithium chloride	.23
Magnesian chloride	35.40
Calcium chloride	108.03
Calcium phosphate	1.97
Calcium carbonate	1.61
Total	1,149.38

Bibl: Reg. of Mines Santa Barbara Co., 1906; State Mineralogist Report XV, pp. 742, 744; U. S. Geol. Surv. Water Supply Paper 338, pp. 295–296.

San Marcos Cold Springs are owned by the Miramar Hotel Company, and are situated 20 miles northwest of Santa Barbara. Elevation 1100 feet.

## Analysis.

## By Prof. J. A. Dodge.

## Constituents are in grains per U. S. gallon.

0	
Silica	0.35
Sodium chloride	1.54
Sodium carbonate	1.92
Calcium carbonate	3.02
Magnesian carbonate	0.67
Calcium sulphate	5.74
Potash and lithium	Trace
Total	13.24

Bibl: State Mineralogist Report XV, pp. 742-743; U. S. Geol. Surv. Water Supply Paper 338, p. 67.

Veronica Springs. Owner, Veronica Springs Company, Salsipuedes street, Santa Barbara. This group of springs, which is commercially the most important in the county, is located in the hills near the coast, three miles west of Santa Barbara. The water is piped to a storage tank having a capacity of 500,000 gallons, and then siphoned into a 50-barrel tank wagon, and hauled to the bottling plant at Santa Barbara.

## Analysis.

## By U. S. Bureau of Chemistry.

#### Constituents are in grains per U. S. gallon.

Magnesium sulphate	1,192.70
Calcium sulphate	69.43
Iron and alumina	.26
Sodium sulphate	344.54
Sodium chloride	233.66
Magnesian nitrate	
Silica	
Magnesian chloride	53.99
Calcium carbonate	145.72
Potassium carbonate	15.71
Total	2.495.45

Bibl: State Mineralogist Report XV, pp. 743-744; U. S. Geol. Surv. Water Supply Paper 338, pp. 294-295, 296.

## OIL SHALE.

The principal deposits of oil shale in California occur in Santa Barbara and Ventura counties, in and near the present producing oil fields. Oil production in the Santa Maria, Casmalia, and Lompoc oil fields is obtained from this oil shale. The oil shale of California is an oil-saturated diatomaceous shale, and differs both physically and chemically from the shales of other parts of the United States and foreign countries. The most extensive oil shale outcrops in Santa Barbara County are located in the Casmalia Hills, north of Casmalia, and in the Santa Ynez Mountains, north of Santa Barbara.

The extraction of shale oil from the bituminous shales by the destructive distillation of oil shale has not as yet attained any great commercial importance in the United States. Two plants have been in operation in Santa Barbara County on an experimental scale for the past four years, with a commercial production beginning in a small way in 1922. The product, in part, has been sold for utilization as a flotation oil in metallurgical work, and part has been consumed at the plants as fuel. The recovery of the by-product ammonium sulphate is an important feature of the process.

A complete description of the oil shale deposits of Santa Barbara County, and a detailed outline of the different processes in use for the extraction of shale oil are given by F. D. Gore, 'Oil Shale in Santa Barbara County,' in State Mineralogist Report XIX, pp. 211–224, therefore only developments that have taken place since that report was

written will be noted.



View of 50-ton Plant and Opencut, Continental Shale Products Company, Schuman, Santa Barbara County.

Continental Shale Products Company, E. M. Markell, president; Harry C. Bell, secretary; Harry C. Ihrig, manager. Offices, Petroleum Securities Bldg., Tenth and Flower streets, Los Angeles. The holdings comprise 40 acres located  $2\frac{1}{2}$  miles northeast of Casmalia, and the plant is located one-quarter mile east of Schuman Siding on the Southern Pacific Railroad.

The beds of bituminous shales which are exposed on the property strike northwesterly along the Schuman anticline. In this locality of the inticline, sharp folding has caused fractured zones that extend from the main body of bituminous shale to the surface, and it is here that oil from below has migrated upward, impregnating the upper bodies of shale. Here, not only are the shales saturated with oil, but all the seams and fissures are filled with asphalt, due to the evaporation of the higher volatile substances in the crude oil.

Developments on this deposit consist of two opencuts, also a tunnel driven west 250 feet through the shale bed. The bituminous shales

exposed above this tunnel are covered with an overburden of unproductive Monterey shale, which is overlain by a shallow depth of soil. The first experimental apparatus for the extraction of shale oil from the bituminous shales was installed on this property by Dr. David T. Day in 1921.

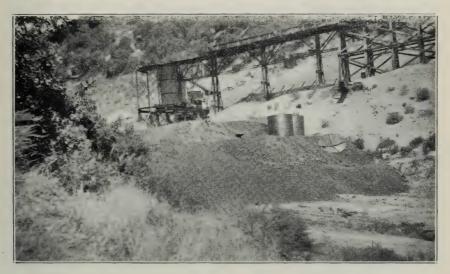


50-ton Generator, Continental Shale Products Company, Schuman, Santa Barbara County.

The Day Process is that of destructive distillation and cracking to obtain lighter oil for the purpose of making gasoline and lubricating oils. For a description of the plant and process the reader is referred to State Mineralogist Report XIX, pp. 216–219. The average amount of oil obtained in test runs from the shale was 30 gallons per ton. The crude oil contains from 1% to 3% pyridine bases. This plant is idle,

as it was not a commercial success, principally due to mechanical difficulties encountered.

In the early part of 1923, the Day experimental process was replaced by a 50-ton ('atlin Retort. The shale mined from the opencut is loaded in small mine cars and trammed to a storage bin having a capacity of 35 tons. The raw shale from the bins is crushed by a set of rolls to about three inches, and is then passed over a 2-inch grizzly to another set of rolls, where it is crushed to 2-inch size. The material is then conveyed to a receiving bin, and then to a shaking screen to eliminate the minus ½-inch product. From the screen it is sent to a bell-shaped hopper over a retort. The shale is then fed to the retort which is 40 feet high and 10 feet in diameter, and arranged for continuous operation. Firing is in an upward direction, but no external heat is necessary, the combustion of the raw material providing all the heat required. The temperature in the retort is maintained at from 1600



40-ton Generator, N. T. U. Company, Casmalia, Santa Barbara County.

to 1750 degrees F. A feature of the operation is the addition of superheated steam. By this process it is reported that over 90% of the total shale oil is recovered. The gravity is about 14° Baumé. The maximum output of the retort is said to be about 100 barrels per day. The plant was not operating when the property was visited, but the company plans to resume operations in the near future.

Bibl: State Mineralogist Report XIX, pp. 216–219.

The N. T. U. Company. D. J. L. Davis, president and general manager; M. A. J. Davis, secretary; G. W. Wallace, consulting engineer; J. E. Quinlan, superintendent. Offices, 2201 Gotham National Bank Building, 1819 Broadway, New York.

This company has a lease on 1600 acres on W. C. Stokes' Ranch, located six miles west of Orcutt, and two miles north of Casmalia. Extensive beds of bituminous shale occur on this property, and follow the Schuman anticline in a northwesterly direction to Corralitos

Canyon. These beds are overlain by an overburden of diatomaceous shale and soil varying in thickness from 10 to 15 feet. About 1100 feet northwest of the plant, the deposit has been developed by an opencut 60 feet in width and height, which enters the beds of shale for a distance of 100 feet. The maximum height of outcrops above the present quarry level is about 240 feet.

After being mined from the quarry, the rock is loaded by hand into cars, and trammed to a hopper at the crushing and loading plant. The material from the hopper is carried by bucket elevator to a roll type of crusher, and is crushed to  $2\frac{1}{2}$ -inch size. The crushed shale then drops direct from the crusher into a 40-ton steel car. The car of crushed shale is then lowered by gravity down a 5 per cent grade, over a standard gauge railway, a distance of 1100 feet, directly over the generator for charging. This car contains a charge of 40 tons of shale, the capacity of the generator. After discharging its load, the steel car is hauled back to the loading plant by means of a cable attached to a 25-h,p. electric hoist.

Process. The generator used is a cylindrical retort of 40 tons capacity, having an inclosed grate at the bottom connected with a suction fan, which creates a down-draft within the retort, passing out

through the grate and a set of condensor tubes and scrubbers.

The operation of the retort is as follows: The generator is filled with crushed shale, and then a fire is started on the top of the charge by means of wood for fuel and some crude oil. The suction fan is then turned on, drawing the heat of this combustion down through the charge of shale. When the shale at the top of the charge is ignited, the cover of the generator is closed so that only enough air is admitted to support slow combustion, which is allowed to continue only on the fixed carbon in the shale. The volatile matter is carried off at a comparatively low temperature by the hot flue gases, and is caught in passing through the water-cooled condensor and scrubbers. A part of this flue gas is mixed with air entering the generator and serves to increase the volume of the gases passing through the charge without increasing the combustion. As the distillation proceeds, the fire zone gradually moves down through the charge, driving off the oil.

A sudden rise in temperature at the grate indicates completion of the distillation. The blower is then shut down and the entire grate is rolled back by means of a motor-operated screw, allowing the spent shale to drop clear of the retort while hot. The grate is then returned to

its position, and the retort is ready for another charge.

Complete distillation takes place in approximately 18 hours. The average run of shale treated by this process is said to be between 30 and 35 gallons to the ton. The recovery made is reported to be 90 per cent of the shale oil. The gravity of the oil is about 14 degrees Baumé.

Plant and equipment are operated by electric power furnished by the San Joaquin Light and Power Company. The company is at present installing three additional generators, each of 40-ton capacity, bringing

the total capacity up to 160 tons.

The company built an experimental plant of 20-ton capacity in the early part of 1922 to develop and perfect a process utilizing internal combustion for the distillation of oil shale. As a result of the opera-

tion of this experimental plant, the company decided to install a commercial unit, and expect to have this 160-ton plant under operation during the latter part of 1925. The crude oil produced is useful for flotation oil, and it yields readily to standard cracking processes. Eight men are employed at the mine and crushing plant, and it will require 18 to 20 men to operate the generator plant.

Bibl: State Mineralogist Report XIX, pp. 219-224.

Oil Shale Deposits of Santa Ynez River Region. Carl L. Milburn and W. S. Rosecrans of Los Angeles have filed on 5000 acres of land which was located under the oil leasing act in T. 5 N., R. 27 W., about 25 miles from the town of Santa Ynez, up the Santa Ynez River, and 12 miles north of Santa Barbara. In this region a belt of Monterey shale outcrops about the flanks of the large anticline, and extends along the river westward from the old quicksilver furnace in Sec. 3, T. 5 N., R. 27 W. It consists of thinly bedded, light-colored organic shale, quite uniformly saturated with oil. This belt of shales strikes southeast through Secs. 4, 10, 11 and 13, following the Santa Ynez fault. Samples taken from opencuts made along this belt of bituminous shales are reported to show about 40 gallons per ton of shale. The deposit is undeveloped.

Bibl: Geology of a part Santa Ynez River District, Santa Barbara County, Report of Geology Department University of California, Vol. 12, No. 1, pp. 1-121, Nov. 20, 1919.

#### PETROLEUM AND NATURAL GAS.

Santa Barbara County ranks sixth in the state in the production of petroleum, having produced in 1923 a total of 3,061,947 barrels, valued at \$2,394,433. The production of natural gas for the year 1923 was 1,612,287 thousand cubic feet, valued at \$172,725.

The oil-producing districts of the county are Casmalia, Cat Canyon, Lompoc, Santa Maria, and Summerland fields, which are described in the various bulletins issued by the State Mining Bureau on the petroleum industry of California, so that no further description will be attempted in this report.

Bibl: State Mineralogist Reports VII, p. 89; XII, p. 537; XIII, p. 582; Bulletins 11, 19, 32, 63, 89; Summary of Operations California Oil Fields.

#### SANDSTONE.

Extensive deposits of tough gray sandstone, suitable for building purposes, are located in this county, but the increased use of concrete in the construction of buildings has almost entirely displaced the sandstone industry, so that very little building stone is now quarried. The principal deposits of sandstone that have been quarried to any extent are located in Mission and Refugio canyons. The high ridge of the Santa Ynez Mountains from Point Concepcion eastward is formed by a great monocline of sandstone that dips toward the ocean on the south. On the range back of Santa Barbara this sandstone is very massive and dips north.

Erickson Quarry is located in T. 9 N., R. 34 W., S. B. M.; J. B. Arellanes of Santa Maria, owner. Some of this rock near Casmalia Station was used for masonry work on the railroad years ago.

Bibl: State Mineralogist Report XIII, p. 637; R. of M. Santa Barbara County, 1906; Bulletin 69, p. 133.

Hogan Quarry is located in Sec. 2, T. 4 N., R. 27 W., S. B. M., three miles north of Santa Barbara, in Sycamore Canyon. Owner, T. M. Hogan, 826 Orange avenue, Santa Barbara. This deposit consists of beds of hard gray sandstone a couple or hundred feet thick, outcropping in Sycamore Canyon for several hundred feet.

Bibl: R. of M. Santa Barbara County, 1906.

Mission Canyon Deposit is two miles north of Santa Barbara. This consists of large boulders of hard, fine-grained buff-colored sandstone, which was quarried by hand years ago by the Franciscan monks, for use about the Santa Barbara Mission.

Bibl: Bulletin 38, p. 133.

Orella Estate Quarry is located in Sec. 12, T. 5 N., R. 31 W., S. B. M., at the head of Refugio Canyon, eight miles north of Orella Station on the Southern Pacific Railroad.

Bibl: Bulletin 38, p. 133.

#### STONE INDUSTRY.

Only a limited supply of rock and gravel suitable for concrete construction is to be found in the immediate vicinity of the principal cities and towns of the county. During the early part of 1925 the city of Santa Barbara suffered severe damage by earthquake, and a great number of the large buildings in the business section were so badly damaged that they will have to be rebuilt. Therefore there will be an increased demand for building materials, in which large amounts of crushed rock, gravel, and sand will be required.

The following individuals and companies were producers during

1924:

Frank A. Gates of Santa Maria, operating a gravel plant located one-half mile south of Sisquoc, on the Santa Maria River. Materials produced consist of crushed rock, gravel, and sand; also manufacturing cement for irrigation pipe.

Mission Santa Barbara, Santa Barbara. P. C. Schuck, Superintendent of Streets, Lompoc. Veronica Stone Company, Santa Barbara.

# OIL FIELD DEVELOPMENT OPERATIONS.

By R. D. Bush, State Oil and Gas Supervisor.

From July 19, 1925, to and including October 31, 1925, the following new wells were reported as ready to drill:

Company	Sec.	Twp.	Range	Well No.	Field
LAMEDA COUNTY					
Calhona Oil Corp	9	35	3	1	Alameda County
RESNO COUNTY:					
Mohawk Oil Co.	$\frac{34}{25}$	20 20	16 14	1 70	Coalinga
Pacific Oil Co	25 25	20	14	79 100	Coalinga
Pacific Oil Co.	25	20	14	101	Coalinga Coalinga Coalinga
Pacific Oil Co Penn-Coalinga Petroleum Co	25	20	14	136	Coalinga
Penn-Coalinga Petroleum Co.	1	20 20	14	16 N-4	Coalinga Coalinga
Zier Oil Co.	î	20	14	N-5	Coalinga
KERN COUNTY:	0.0	200	0.1		
Bear State Oil Co. Lacy-Esper Petroleum Co.	30 18	28 29	21 22	14	Belridge Belridge
Myrtle E. Oil Co.	8	29	21	1	Belridge
Devils Den Products Co	24	25	18	1	Devils Den
Belridge Oil Co.	$\frac{34}{34}$	30 30	24 24	8	Elk Hills Elk Hills
Myrtle E. Oil Co  Devils Den Products Co  Belridge Oil Co  Belridge Oil Co  Belridge Oil Co	34	30	24	10	Elk Hills Elk Hills
Belridge Oil Co.	34	30	24	14	Elk Hills
Belridge Oil Co. Belridge Oil Co. Belridge Oil Co. Chas. Differding, Trustee Elk Hills Petroleum Co.	34 34	30	24 24	16 18	Elk Hills
Chas Differding Trustee	26	30	24	18	Elk Hills
Elk Hills Petroleum Co.	34	30	24	1	Elk Hills Elk Hills Elk Hills
Elk Hills Petroleum Co	34	30	24	4	Elk Hills
Elk Hills Petroleum Co.	$\frac{34}{34}$	30	24 24	5 6 7 8 9	Elk Hills
Elk Hills Petroleum Co.	34	30	24	7	Elk Hılls Elk Hills
Elk Hills Petroleum Co	34	30	24	8	Elk Hills
Elk Hills Petroleum Co	34	30	24	9	Elk Hills Elk Hills Elk Hills
Elk Hills Petroleum Co. Gross Drilling Co. Sross Drilling Co. North Elk Oil Co.	26 26	30	24 24	2 3	Elk Hills Elk Hills
North Elk Oil Co.	22	30	24	1	Elk Hills
Pacific Off Co.	27	30	24	18	Elk Hills
Pacific Oil Co.	27 27	30	24 24	20 25	Elk Hills
Pacific Oil Co	27	30	24	26	Elk Hills Elk Hills
Pacific Oil Co.	35	30	24	82	Elk Hills
Pacific Oil Co.	35	30	24	122	Elk Hills
Pan American Petroleum Co Pan American Petroleum Co	3	31	24 24	Crampton K 2 Crampton K 3	Elk Hills Elk Hills
Union Oil Co	26	30	24	Elk Hills 12	Elk Hills
The United Oil Co. Boston Petroleum Co. California Mutual Finance Corp. George F. Getty, Inc.	22	30	24	Slater 1 25	Elk Hills Elk Hills
Boston Petroleum Co.	20	28 29	28 28	$\begin{array}{c} 25 \\ 12 \end{array}$	Kern River
George F Getty Inc	14	28	27	Lehnardt 2	Kern River Kern River
Gray Heirs	11	29	28	3	Kern River
Petroleum Securities Co.	22 22	28	27	$\frac{2}{3}$	Kern River
Petroleum Securities Co	8	28 29	27 28	12	Kern River Kern River
Petroleum Securities Co. Petroleum Securities Co. Richards Oil Co. F. G. Wagner Ridge Oil Co. Washington Petroleum Corp.	34	28	28	3	Kern River
Ridge Oil Co.	13	30	21	1	McKittrick
Washington Petroleum Corp Balboa Oil Co	8 24	30	22 23	$\begin{array}{c} 5 \\ 42 \end{array}$	McKittrick
Balboa Oil Co.	24	31	23	43	Midway Midway
Balboa Oil Co. C. C. M. O. Co. C. C. M. O. Co. C. C. M. O. Co.	27	31	22	4	Midway Midway
C. C. M. O. Co.	35	31	22	14	Midway
C. C. M. O. Co.	22 34	31 32	22 24	35 Dorothy 4	Midway Midway
C. M. CCo. California Petroleum Corp. California Petroleum Corp. E. & M. Oil Co., Inc. Gilmore Oil Co. Gralan Oil Co. Honolulu Consolidated Oil Co. Honolulu Consolidated Oil Co. Honolulu Consolidated Oil Co.	34	32	24	Dorothy 6 2-A	Midway
E. & M. Oil Co., Inc.	10	31	22		Midway
Gilmore Oil Co.	27	31 32	22 23	4 5	Midway
Honolulu Consolidated Oil Co.	4	32	23	23	Midway Midway
Honolulu Consolidated Oil Co.	4	32	24	24	Midway
Honolulu Consolidated Oil Co.	4	32	24	43	Midway
Honolulu Consolidated Oil Co.	4 4	32	$\frac{24}{24}$	44	Midway
Honolulu Consolidated Oil Co.	2	32	24	53 57	Midway Midway
Honolulu Consolidated Oil Co.	4 2	32	24	63	Midway
Honolulu Consolidated Oil Co.	. 2	32	24	68	Midway
TT 1-1- C1:1 / 1 0:1 C-	. 8	32	24	68	Midway

Company	Sec.	Twp.	Range	Well No.	Field
KERN COUNTY—Continued. Midland Oilfields Co., Ltd. Midland Oilfields Co., Ltd. Midland Oilfields Co., Ltd. North American Oil Cons. Pacific Oil Co. Ta Southwestern Petroleum Co. The Springs Co. Surprise Oil Co. The United Oil Co. The United Oil Co. Valley Oil Co. Valley Oil Co. United Oil Co. General Petroleum Corp. General Petroleum Corp. General Petroleum Corp.	34 24 34 32 32 30 30 30 30 5 19 19 19 22 28 36 20 19 14 21 32 32 33 36 30 30 30 30 30 30 30 30 30 30 30 30 30	31 31 31 31 31 31 31 31 31 32 31 31 31 31 31 31 31 31 31 31 31 31 31	24 23 24 24 24 24 24 24 24 24 24 24 24 22 24 22 23 23 23 23 23 23	6 18 B-3 5 5 25 26 26 27 32 35 5 11 18 8 20 26 37 65 8 28-1 11 Calidon 5 4 8 8 10 10-A 10-B	Midway Mi
General Petroleum Corp. Lewis Petroleum Co. Midland Oilfields Co., Ltd. Midland Oilfields Co., Ltd. Midland Oilfields Co., Ltd. Midland Oilfields Co. Pacific Oil Co. Pacific Oil Co. Standard Oil Co. The United Oil Co. Hastain & Purman, Inc. Standard Oil Co. John K. Porter Standard Oil Co. Standard Oil Co. Standard Oil Co.  John K. Porter Standard Oil Co. Standard Oil Co. Standard Oil Co. Standard Oil Co.	32 32 32 27 25 36 32 1 27 32 35 27	11 12 12 12 12 12 12 12 12 12 12 12 12 1	23 24 23 23 23 24 24 23 24 23 20 20 20	Maricopa Star 1  Maricopa Star 1  1  1  1  15  5-A  M. J. M. & M. 60  Transport 1  Kern Co.  Lease 2 16  Cahn Test 1  Miller & Lux  Option 2	Sunset Su
Shell Co. Shell Co. Associated Oil Co. Associated Oil Co. Associated Oil Co. Associated Oil Cc. Mohawk Oil & Gas Syn. Pacific Oil Co. Securities Co. Petroleum Securities Co. Petroleum Securities Co. Petroleum Securities Co. Shell Co. Smith, Rucker, Wilson Standard Oil Co.	34 34 34 37 7 7 7 7 7 7 17 18 8 8 8 8 8 8 8 8 17 17 18 8 8 18 17 17 18 8 18 18 18 19 10 11 11 11 11 11 11 11 11 11	332222222222222222222222222222222222222	13 13 14 14 14 14 14 14 14 14 14 14 14 14 14	Reyes 30 Reyes 31 Vickers 19 Vickers 21 Vickers 26 Vickers 26 Selection of the selection of	Dominguez Dominguez Inglewood Inglew

		,	1		
Company	Sec	Twp.	Range	Well No.	Field
LOS ANGELES COUNTY-Cont.					
Burke Oil Co	24	4	13	1	Long Beach
Burke Oil Co	24	-1	13	2	Long Beach
Bush-Voorhis Oil Co. California Petroleum Corp.	24 19	4 4	13 12	Fields 17	Long Beach Long Beach
E. E. Combs Business Trust No. 3	24	4	13	E. E. Combs 3	Long Beach
Cook, Miller & McKinnis	13	4	13	2	Long Beach
Craig, Burns & Co., Inc.	13	4	13	4	Long Beach
Craig, Burns & Co., Inc.	13	4	13	Sneden 1	Long Beach
Joseph B. Dabney A. J. Delaney	24 13	4 4	13 13	1 9	Long Beach Long Beach
A. J. Delaney	13	4	13	3	Long Beach
A. J. Delanev	13	4	13	4	Long Beach
A. J. Delaney Featherstone & Preston	19	4	12	Delaney 1	Long Beach
Featherstone & Preston	$\frac{24}{24}$	3 4	13 13	Featherstone 8 Featherstone 9	Long Beach Long Beach
Featherstone & Preston	24	4	13	Featherstone 10	Long Beach
Featherstone & Preston	24	4	13	Featherstone 11	Long Beach
Featherstone & Preston	24	4	13	Featherstone 12	Long Beach
Walter H. Fisher Corp.	30	4	12	5-B	Long Beach
Nathan W. Hale Nathan W. Hale	18 9	4 4	12 12	Hale McAdoo 1	Long Beach Long Beach
Herwick Interests	24	4	13	Herwick 24	Long Beach
Herwick Interests R. E. Ibbetson Drilling Co. R. E. Ibbetson Drilling Co. A. T. Jergins Trust Geo. W. Johnson Geo. W. Johnson Kohlbush & Johnston	24	4	13	4	Long Beach
R. E. Ibbetson Drilling Co.	13	4	13	5	Long Beach
A. T. Jergins Trust	19	4	12	17-A	Long Beach Long Beach
Geo. W. Johnson	13 13	4 4	13 13	$\frac{1}{2}$	Long Beach
Kohlbush & Johnston	13	4	13	Kohlbush &	Tiong Deach
				Johnston 1	Long Beach
Lake View No. 2 Oil Co.	13	4	13	1	Long Beach
Macmillan Petroleum Products Co	13 24	4 4	13 13	McKeon 4	Long Beach
McKeon Drilling Co., Inc.	24	4	19	O'Donnell 1	Long Beach
H. W. Nall	24	4	13	Kathryn F.	Long Beach
J. E. O'Donnell	24	4	13	O'Donnell 44	Long Beach
J. E. O'Donnell	19	4	12	O'Donnell 45	Long Beach
J. E. O'Donnell J. E. O'Donnell	18 19	4 4	12 12	O'Donnell 46 O'Donnell 47	Long Beach Long Beach
J. E. O'Donnell	18	4	12	O'Donnell 48	Long Beach
Progressive Burnett Syn.	30	4	12	3	Long Beach
Rainbow Petroleum Co	19	4	12	3	Long Beach
W. R. Ramsey	28	4	12	B-6	Long Beach
W. R. Ramsey Richmond Oil Co.	28 19	4 4	12 12	B-7	Long Beach Long Beach
Ring Petroleum Corn	13	4	13	Grant 1	Long Beach
San Martinez Oil Co.	29	4	12	Fry 3	Long Beach
San Martinez Oil Co.	29	4	12	Greene Comm. 3	Long Beach
J. T. Shepard Sunset Petroleum Co.	24 24	4 4	13	1	Long Beach Long Beach
Sunset Petroleum Co.	19	4	12	2	Long Beach
Umpire Petroleum Corp.	13	4	13	5	Long Beach
Umpire Petroleum Corp.—Apex			10		T 70 1
Petroleum Corp.	24	4	13	4	Long Beach
The United Oil Co	13 19	4 4	13 12	Stewart 1	Long Beach Long Beach
R. Whiston	24	4	13	McMillan 1	Long Beach
Young & Theriot	13	4	13	Nigus 1	Long Beach
Howard Zellers	13	4	13	1	Long Beach
McGinley Oil CoSt. Helens Riverside Properties	$\frac{6}{2}$	2	11 12	Monterey 10	Montebello Montebello
Standard Oil Co	6	2 2 2 3 3 3 3	11	Baldwin 64	Montebello
Superior Oil Co.	6	2	12	Anderson A-1	Montebello
Superior Oil Co. Wm. G. McAdoo, Jr. G. S. Willhoite & A. G. McCoy	6	3	15	1	Newhall
G. S. Willhoite & A. G. McCoy	6	3	15	010	Newhall
Barnsdall Oil Co. Barnsdall Oil Co.	18 18	3	13 13	O'Dea 4 O'Dea 6	Rosecrans Rosecrans
Barnsdall Oil Co.	18	3	13	O'Dea 7	Rosecrans
Barnsdall Oil Co.	20	3	13	Rosecrans 7	Rosecrans
Walter H. Fisher Corp.	7	3	13	13	Rosecrans
B. E. Gerner	7	3	13	Bud Gerner 2	Rosecrans
Henderson Petroleum Corp Hitchcock & Ort	7 7 7 7 7	3 3	13 13	Athens 3 H. & O. 14	Rosecrans Rosecrans
Marine Corp.	7	3	13	39	Rosecrans
Marine CorpStar Petroleum Co	18	3	13	Shoemaker 2	Rosecrans
Union Oil Co.	18	3	13	Howard Park 17	Rosecrans
Union Oil Co.	18	3	13	Howard Park 25 Howard Park 26	Rosecrans
Union Oil Co. Union Oil Co.	18 18	3	13 13	Rosecrans 6	Rosecrans Rosecrans
I nion ()il Co	18	3	13	Trust 4	Rosecrans
Ambassador Petroleum Co.	5	3 3 3 3 3 3 3 3	11	Baker 6	Santa Fe Springs
Bandini Petroleum Co	5	3	11	Off 5	Santa Fe Springs
Bandini Petroleum Co.	5	3	11	Off 6	Santa Fe Springs

Company	Sec.	Twp	Range	Well No.	Field
California Petroleum Corp. California Petroleum Corp. C. C. M. O. Co.	5 9 9 9 16 9 16 9 8 8 8	3 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	11 14 14 14 14 14 14 14 14 14 14 14	Wickman 2 Del Amo 28 Del Amo 33 Del Amo 35 Del Amo 41 Del Amo 47 Del Amo 47 Del Amo 53 Del Amo 99 Del Amo 99 Redondo Imp.	Santa Fe Springs Torrance
Harry Crinklaw Wm. E. Garner General Petroleum Corp. General Petroleum Corp. R. & D. Oil Co.	17 18 8 8 9	4 4 4 4 4	13 13 14 14 14 14	Co. 4 1 1 Carson 11 Carson 12 1 Redondo Comm. 5	Torrance Torrance Torrance Torrance Torrance Torrance Torrance
Shell Co.	9	4	14	Redondo Comm. 6	Torrance
Shell Co. Shell Co. Shell Co. Shell Co. Standard Oil Co. California Petroleum Corp.	9 9 9 22 17	4 4 4 4 2	14 14 14 14 11	Torrance 6 Torrance 5 Torrance 7 Marble Lease 2 5 Rideout	Torrance Torrance Torrance Torrance
California Petroleum Corp.	17	2	11	Hamburg 2 Seward-	Whittier
California Petroleum Corp. Central Oil Co. of Los Angeles. Bardeen Oil Co. Elbe Oil Land Development Co. A. T. Jergins Trust. Marland Oil Co. Milham Exploration Co. Petroleum Securities Co. Shell Co. W. W. Stabler. Thedieck, Brown & Manson.	17 23 9 13 34 2 11 35 36 18	2 2 2 2 4 5 4 4 2 5 4	11 11 10 15 14 12 16 14 10 16 12	Rideout 3 Witte Vining 2 76 3 6 Palos Verdes 1 Bixby 1 Conroy 1 Narbonne 1 Menchego 1-A Jenkins 1	Whittier Whittier Whittier Los Angeles County
ORANGE COUNTY: Birch Oil Co. Brea Canon Oil Co. C. C. M. O. Co. Fullerton Oil Co. Central Oil Co. Richland Oil Co. Southern California Drilling Co. Standard Oil Co. Julian Petroleum Corp. Marine Corp. J. J. Rekar Sunland Oil Assn. Western Pacific Oil Co. Standard Oil Co. Standard Oil Co.	2 2 9 2 2 2 2 34 3 2 2 4 4 34 21 17 21 14 21 21 21 22 29	3 3 3 3 6 6 6 6 5 6 6 6 6 6 6 6 6 6 6 6	10 10 9 10 11 11 11 11 11 11 11 10 10 10 10 10	2-A 38 98 20 Hesse 1 Granis 1 Bolsa 22 Huntington B 36 Huntington B 38 Huntington B 38 Jones Comm. 5 Heights 2 Mesa 3 Hartley 1 Mesa 2 Mesa 3 Costa Mesa 53 1 Adams 1 Kraemer	Brea Olinda Brea Olinda Brea Olinda Brea Olinda Brea Olinda Huntington Beach Newport
	29	3	9	No. 2 20 Coyle & Bogue 4	Richfield Richfield
Union Oil Co. Frank R. Anderson, Geo. A. Parsons, C. E. Kelly Quadri Petroleum Co. Shell Co. Henry Whiteup	13 7 30 27	8 3 5 6	8 8 10 10	Von Schriltz 1	Orange County Orange County Orange County Orange County
RIVERSIDE COUNTY: Beaumont Riverside Oil Syn	18 17	3 4	1 6	1-A 1	Riverside County Riverside County
SAN BENITO COUNTY: Reorganized Homestake Divide Mining Co	8	17	11	1	San Benito County

			1		
Company	Sec.	Twp	Range	Well No.	Field
SAN BERNARDINO COUNTY:					
Thomas C. Bannon Zenith Oil Co	32 32	2 2	8 8	$\frac{1}{2}$	San Bernardino Co. San Bernardino Co.
	02	_ ~		~	Sun Bernardino Co.
SAN LUIS OBISPO COUNTY: A. J. Crose	34	28	13	1	San Luis Obispo Co.
Fox & McCoy	Lot 133	27	11	Walkin 18	San Luis Obispo Co.
Livermore & Phelps	8	32	22	1	San Luis Obispo Co.
Carter Mullaly Paso Robles Gas Co	7	32 26	22 12	1	San Luis Obispo Co. San Luis Obispo Co.
	10		12	•	Cur Bulb Oblepo Co.
SANTA BARBARA COUNTY: Pan American Petroleum Co		9	34	Soladino 25	Casmalia
Brooks Oil Co.	32	9	32	6	Cat Canyon
Brooks Oil Co.	32 32	9	32 32	6-A	Cat Canyon
Brooks Oil Co	29	9	32	Stendell 6	Cat Canyon Cat Canyon
R. & G. Oil Co.	30	9	32	5	Cat Canyon
TULARE COUNTY:					
Hub Oil Co.	27	22	27	2	Tulare County
VENTURA COUNTY:					
Montebello Oil Co.	4	3	19	Shiells 119	Bardsdale
Montebello Oil Co C. A. Harding, Trustee	4 34	3 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	19 20	Shiells 120	Bardsdale Conejo
C. A. Harding, Trustee	34	2	20	15	Conejo
C. A. Harding, Trustee	34	2	20	16	Conejo
C. A. Harding, Trustee	34	2	20	17	Conejo
C. A. Harding, Trustee	34 34	2	$\begin{vmatrix} 20 \\ 20 \end{vmatrix}$	18	Conejo
C. A. Harding, Trustee C. A. Harding, Trustee	33	2	20	19 47	Conejo Conejo
C. A. Harding, Trustee	33	2	20	48	Conejo
C A Harding Trustee	33	2	20	49	Conejo
C. A. Harding, Trustee C. A. Harding, Trustee	33	2	20	50	Conejo
C. A. Harding, Trustee	33	2	20	51	Conejo
C. A. Harding, Trustee Surprise Oil Syn	33 33	2	$\frac{20}{20}$	52 7	Conejo Conejo
Surprise Oil Syn.	33	2	20	8	Conejo
Moherb Oil Co.	35	$\frac{7}{4}$	18	ĭ	Piru *
Schell & Jennings	32	4	18	9	Piru
F. G. Warner	36	4	18	Warner 1	Piru
Hoyt S. Gale	29	2	21	Beardsley 1	Simi
Oak Ridge Oil Co	13 27	2 3 3 3	$\frac{21}{23}$	Harvey 16 Lloyd 11	South Mountain Ventura
Associated Oil Co.	27	3	23	Lloyd 20	Ventura
Associated Oil Co.	27	3	23	Llovd 26	Ventura
Associated Oil Co.	26	3	23	Lloyd 101	Ventura
C. C. M. O. Co.	22	3	23	Hobson 1-A	Ventura
A. F. Calhoun J. A. Hess	9 33	3 4	23 23	18	Ventura Ventura
J. A. Hess	34	4	23	4-A	Ventura
Shell Co.	29	3	23	Taylor 10	Ventura
Standard Oil Co.	17	2	22	Argabrite 1	Ventura County

#### SPECIAL ARTICLES.

Detailed technical reports on special subjects, the result of research work or extended field investigations, will continue to be issued as separate bulletins by the Bureau, as has been the custom in the past.

Shorter and less elaborate technical papers and articles by members of the staff and others are published in each number of 'Mining in California.'

It is anticipated that these special articles will cover a wide range of subjects both of historical and current interest; descriptions of new processes, or metallurgical and industrial plants, new mineral occurrences, and interesting geological formations, as well as articles intended to supply practical and timely information on the problems of the prospector and miner, such as the text of new laws and official regulations and notices affecting the mineral industry.

#### DIRECTORY OF CALIFORNIA FOUNDRIES.

The result of the tests on California Foundry Sands, carried out by the Joint Committee on Molding Sand Research and the Engineering Division of the National Research Council, were published in 'Mining in California,' issue of April, 1925.

In connection with this work, a list of the foundrymen of each state was compiled for the use of the State Geologist or other cooperating state official.

The list of California foundries has just been furnished the State Mining Bureau by the American Foundrymen's Association, and is published herewith in the hope that it will be of benefit to producers of molding sand and other foundry supplies.

#### California Foundries.

Alameda:

McKinney and Spies, 2319 Clement St.

Albambra :

Braun, C. F., 1200 S. Fremont St.

Southern California Foundry Co., 1170 Westminster Ave.

Angels Camp:

Angels Iron Works.

Bakersfield:

Bakersfield Iron Works.

Bay Point:

Bay Point Foundry Co.

Berkeley:

Berkeley Brass Foundry Co., 2629 Seventh St. Greene Steel Castings Co., 1302 Second St.

Macaulay Foundry Co., H. C., Sixth and Carlton Sts.

Oakland Furnace and Foundry Co., Fourth and Bancroft Way.

Burbank:

American Aluminum Metal Products Co.

Moreland Motor Truck Co.

Chico:

Chico Iron Works, 744 Broadway.

Coalinga:

Bunting Iron Works.

Emeryville:

Connelley Brass Foundry, E. R., 4064 Holden St.

Judson Manufacturing Co.

Western Aluminum Manufacturing Co., Forty-fifth and Holden Sts.

Eureka:

Acme Foundry, 268 Hillsdale St.

New Eureka Foundry, First and S Sts.

Fresno:

Burnett Iron Works, Inc., J. II.

Federal Foundry Co., 1939 Webster St.

Lisenby Manufacturing Co., Kern and Angus Sts.

Mathews Foundry Co.

Valley Foundry and Machine Works, 710 H St.

Grass Valley:

George Bros.

Taylor's Foundry and Engineering Co.

Long Beach:

Long Beach Iron Works, 2220 W. Anaheim St.

Los Angeles:

"A" Brass Foundry, 2046 E. Vernon Ave.

Alloy Steel and Metal Co., Fifty-fifth and Alameda Sts.

Aluminum Castings Co., 1724 Naud St.

American Brake Shoe and Foundry Co. of California, 1170 E. Thirty-second St.

American Foundry Co., 906 Date St.

Atlas Brass Foundry, Inc., 1901 Santa Fe Ave.

Axelson Machine Co., Boyle and Randolph Aves.

Bayer-Rothgeb Co., Slauson and Santa Fe Ave.

Bunce Metal Products, 2652 Long Beach Ave.

Cain Gas Radiator Co., W. H., 5215 Moneta Ave.

California Brass Manufacturing Co., 1444 N. Main St.

Cass Foundry, 2501 E. Twenty-fifth St.

Clark-Turner Piston Co., 2251 E. Seventh St.

Commercial Iron Works, 2424 Porter St.

D. and B. Pump and Supply Co., 301 West Blvd.

Earle Hardware Manufacturing Co., 2369 E. Fifty-first St.

Federal Brass Foundry Co., 5330 Santa Fe Ave. Ferrell Brass Foundry, 110 E. Seventeenth St.

Fulton Engine Works, N. Main and Alhambra Rd.

Graham Iron Works, 2724 Sante Fe Ave.

Griffin Wheel Co., 5421 Santa Fe Ave., Vernon.

Hartman, Fred C., 632 Mateo St.

Hercules Foundries, Inc., Boyle and Slauson Ave., Huntington Park.

Hess and Sacket, Inc., 601 W. Belgrave St., Huntington Park.

Independent Iron Works, 2416 Lenard St.

Johnson Foundry and Machine Works, 1009 N. Main St.

Jones Co., James, 201 Leroy St.

Kain Fixture and Brass Works, 113 W. Ann St.

Kay-Brunner Steel Casting Co., 2720 Frederick St.

Keystone Iron and Steel Works, 3601 Santa Fe Avc.

Kingman Manufacturing Co., 2201 S. Main St.

Layne and Bowler Corp., 900 Santa Fe Ave.

Lily Foundry Co., 2268 E. Fifteenth St.

Llewellyn Iron Works, N. Main and Redondo Sts.

Los Angeles Brass Foundry, 1539 E. Sixteenth St.

Los Angeles Foundry Co., 2444 S. Alameda St.

Los Angeles Valve and Fittings Co., 2741 Compton Ave.

Madsen Iron Works, 5529 Bicket St., Huntington Park.

Magnus Co., Inc., 860 N. Main St.

Martin Iron Works, 1222 E. Twenty-eighth St.

Master Foundry, 1008 Santee St.

Mechanical Pattern Works, Inc., Tenth and Stanford Sts.

Metal Supply Co., 2323 E. Fifty-second St. Meyberg Co., 631 S. Grand St.

Miller Engineering and Foundry Works, 2652 Long Beach Ave.

National Brass Works, Inc., 2140 E. Twenty-fifth St.

Pacific Brass and Hardware Co., 1646 N. Spring St.

Pacific Copper and Brass Works, 1915 E. Seventh St

Pacific Faucet Manufacturing Co., 940 E, Sixtieth St.

Pacific Gas Radiator Co., Harbor Truck Blvd.

Phillips Bronze Bushing Works, 1460 E. Washington St.

Pioneer Brass Works, 1531 E. Thirty-second St.

Podas Foundry Co., 2001 E. Slauson Ave.

Price-Corcoran-Pfister Co., 2923 Humboldt St.

Public Service Brass Corp., 721 E. Slauson Ave., Huntington Park.

Quality Foundry and Manufacturing Co., 2411 Modoc St.

Reliable Iron Foundry, 207 Mesnager St.

Republic Brass and Manufacturing Co., 2115 E. Twenty-seventh St.

Rich Steel Products Co., 3855 Santa Fe Ave.

Snow Manufacturing Co., 2437 E. Twenty-fourth St.

Super-Refined Metals Co., 315 West Blvd.

Union Brass Works, 723 N. Main St.

United Casting Co., Wilson and Violet Sts.

Vernon Foundry, 2601 Twenty-sixth St.

Warman Steel Casting Co., Box 639, Station C.

Washington Iron Works, 1141 Mateo St. Western Machinery Co., 900 N. Main St.

Western Malleable Castings Co., Boyle and Slauson Aves.

Marysville:

Empire Foundry and Machine Works, 424 F St.

Nevada City:

Miner's Foundry and Supply Co.

Newark:

Graham Manufacturing Co.

Niles:

Victory Manufacturing Co.

Oakland:

American Manganese Steel Co.

Best Steel Casting Co., 105th Ave., Station G.

Block Brass Foundry Co., Inc., 760 Twenty-third Ave.

California Foundries, Inc., 950 Nineteenth St.

Dalton and Sons Co., Henry, Cedar, Ninth and Tenth Sts.

DeRome's Bronze, Brass and Bell Foundry, E., 1978 Fifty-ninth St.

Du Mont's Foundry, 2319 Union St.

Economy Mills, 752 High St.

Empire Foundry Co., Inc., 429 Third St.

Hammer-Bray Co., Foot of Madison St.

Key System Transit Co., Twenty-second and Grove Sts.

Marchant's Foundry, Fourth and Powell Sts., Emeryville.

Oakland Brass Foundry, 928 Twenty-third Ave.

Pacific Diesel Engine Co., 2896 Glascock St.

Pacific Malleable Castings Co., Foot of Eighty-fifth St.

Phoenix Iron Works Co., 703 Second St.

Standard Brass Casting Co., 600 Third St.

Standard Gas Engine Co., Denison and King Sts.

United Iron Works, Second and Jefferson Sts.

Western Stove and Range Co. (Elmhurst).

Ontario:

Edison Electric Appliance Co., Inc. Oxnard:

Brenneis Manufacturing Co.

Pasadena:

Hangliter Manufacturing Co., 983 S. Raymond Ave.

Hopping Bros. Foundry, 367 S. Broadway.

Reliance Manufacturing Co., 1020 S. Broadway.

Pittsburg:

Columbia Steel Corp.

Placerville:

Morey, F. H.

Pomona:

Pomona Manufacturing Company.

Porterville:

Porterville Foundry, Box 581,

Red Bluff:

Hammer, H. H.

Redding:

Johnson Iron Works, I. J.

Redding Iron Works.

Richmond:

Pacific Sanitary Manufacturing Co., 67 New Montgomery St.

Pullman Co., Pullman and South Sts.

Santa Fe Foundry Co., D and Clinton Sts.

Riverside:

Parker Machine Works.

Riverside Foundry, 176 N. Main St.

Sacramento:

Berry, R., 1817 Twenty-ninth St.

Brainard Bros.

Southern Pacific Co.

San Bernardino:

Ellis Iron Works, 135 Arrowhead Ave.

Hanford Iron Works, 101 S. Arrowhead Ave.

Parker Iron Works, Inc., 943 Third St.

Santa Fe R. R. Shop Brass Foundry.

San Diego:

Barth, W. G., 1101 W. Nutmeg St.

California Iron Works.

Higgins Manufacturing Co., J. C., 2228 Kettner Blvd.

San Diego Brass Co., 1511 J St.

San Diego Machine Co., 739 Fourth St.

Standard Iron Works.

San Francisco:

Ajax Foundry Co., 58 Clementina St.

American Brake Shoe and Foundry Company of California, 303 New Call Bldg,

American Brass and Bronze Works, 124 Juniper St.

Bell Casting Co., 1504 Vallejo St.

Bethlehem Shipbuilding Corp., Ltd., Twentieth and Illinois Sts.

Brown Co., J. H., 755 Brannan St.

Bunting Iron Works, 1216 First National Bank Bldg.

Columbia Steel Corp., Balfour Bldg.

David Co., P., Sharon Bldg. Dyer, F. G., 766 Folsom St.

Enterprise Foundry Co., 2902 Nineteenth St.

Eureka Foundry, 625 Brannan St.

Excelsior Brass Works, 1168 Bryant St.

Federal Ornamental Iron and Bronze Co., Sixteenth and San Bruno Sts.

Garratt and Co., W. T., 277 Fremont St.

Golden Gate Brass Manufacturing Co., 251 Second St.

Golden State and Miners Iron Works, 249 First St.

Greenberg's Sons, M., 765 Folsom St.

Hendy Iron Works, Joshua, 75 Fremont St.

Jewell Steel and Malleable Co. of Cal., Potrero and Twenty-fifth Sts.

Judson Manufacturing Co., 819 Folsom St.

Kingwell Bros. Brass Foundry, 444 Natoma St.

Krenz Copper and Brass Works, Inc., Oscar, 612 Bryant St.

Liberty Brass and Bronze Foundry, Sherman and Cleveland Sts.

Market Street Railway Co., San Jose and Geneva Aves.

McCormack Bros. Iron Works, Main and Folsom Sts.

McKay Foundry Co., Seventeenth and Missouri Sts.

Mission Foundry and Stove Works, 2256 Harrison St.

Moore-Noble Foundry Co., Seventeenth and Mississippi Sts.

Pacific Brass and Bronze Foundry, 528 Folsom St.

Pacific Diesel Engine Co., 433 California St.

Pacific Foundry Co., Harrison and Eighteenth Sts.

Pacific Metal Works, Inc., 153 First St.

Pacific Sanitary Manufacturing Co., 67 Montgomery St.

Polytechnic High School, Frederick and First Sts.

Rincon Foundry Co., 349 Seventh St.

San Francisco Brass Foundry, 48 Clementina St.

San Francisco Stove Works, 260 Townsend St.

Star Aluminum Foundry, 3619 Eighteenth St.

Steiger and Kerr Stove and Foundry Co., Folsom and Eighteenth Sts.

Vulcan Iron Works, 1849 Kearney St.

Western Brass Manufacturing Co., 217 Tehama St.

Western Foundry, 912 Folsom St.

San Jose:

Anderson Barngrover Manufacturing Co.

Axford and DeShields Brass Foundry, 61 S. Fourth St.

Bean Spray Pump Co., 217 W. Julian St.

San Luis Obispo:

Smith Foundry, F. L., 254 Higuera St.

Santa Ana:

Kinslow Foundry, H. H., 902 E. Third St. P. V. and R. Products Co., 1316 Santiago St.

Santa Ana Iron Works, 924 E. First St.

Santa Cruz:

Enterprise Machine Works, Water and River Sts.

Santa Rosa

Pioneer Machine Works and Iron and Brass Foundry.

Sonora:

Curnow, R. C.

Stanford University:

Leland Stanford University.

Stockton:

Augustine Brass Foundry.

Engineering and Foundry Co., 800 N. East St.

Holt Manufacturing Co.

Monarch Foundry Co., Inc., Sacramento and Oak Sts.

Stockton Iron Works, Lindsay and Harrison Sts.

Sunnyvale:

Hendy Iron Works, Joshua.

Sutter Creek:

Knight Company.

Taft (Kern County):

Midway Iron and Brass Foundry.

Torrance

Columbia Steel Corp.

Union Tool Co.

Tuolumne:

Tuolumne Foundry and Machine Works.

Upland:

Upland Manufacturing Co.

Valleio:

U. S. Navy Yard Foundry (Mare Island).

Ventura

Ventura Manufacturing and Implement Co.

Vernon :

Whiting-Mead Co., 2035 E. Vernon St.

Visalia :

Visalia Foundry, Machine Shops and Garage, Inc., 811 E. Main St.

Wilmington:

Wilmington Brass Foundry.

## ADMINISTRATIVE DIVISION.

WALTER W. BRADLEY, Deputy State Mineralogist.

## Personnel.

There have been no changes or additions in the personnel of the Bureau, to be noted, during the past quarter.

#### New Publications.

During the quarterly period covered by this issue, the following Bureau publications have been made available for distribution:

Bulletin No. 95. "Geology and Ore Deposits of the Randsburg Quadrangle," by Carlton D. Hulin. Cloth bound; 148 pp., profusely illustrated, also accompanied by a geological map in five colors and by five maps of mining claims and underground workings. Price \$2.00 postpaid.

Mining in California (quarterly), July, 1925, being Chapter 3 of State Mineral-

ogist's Report XXI. Price 25 cents.

Summary of Operations, California Oil Fields: Vol. 10, Nos. 10, 11, and 12, April,

May, and June, 1925, respectively.

Commercial Mineral Notes: Nos. 29, 30, 31, August-October (inc.). These 'notes' carry the lists of 'mineral deposits wanted' and 'minerals for sale,' issued in the form of a mimeographed sheet, monthly. It is free of charge to those on the mailing list for 'Mining in California.'

#### Mails and Files.

The Bureau maintains, in addition to its correspondence file and the library, a mine report file which includes reports on some 7500 mines and mineral properties in California. Also, there is available to the public a file of the permits granted to mining and oil corporations by the State Commissioner of Corporations.

During the period covered by this quarterly report, there were 1667 letters received and answered at the San Francisco office alone, covering almost every phase of prospecting, mining and developing mineral deposits, reduction problems, and marketing of refined products.

## DIVISION OF MINERALS AND STATISTICS.

Statistics, Museum, Laboratory.

WALTER W. BRADLEY, Deputy State Mineralogist.

#### STATISTICS.

Data on the 1924 production of some of California's minerals were given in both the April and July issues of Mining in California, and figures on additional substances are presented herein, together with tabulations showing the completed totals for all substances for that year, grouped both by substances and by counties. The complete, detailed, annual report on the mineral production of California for 1924 is now in press, as Bulletin No. 96 of the State Mining Bureau.

## Summary for 1924.

The total value of the mineral output of California for the year 1924 was \$374,620,789 being an increase of \$30,596,111 over the 1923 total of \$344,024,678. There were sixty different mineral substances, exclusive of a segregation of the various stones grouped under gems; and all of the fifty-eight counties of the state contributed to the list.

The salient features of 1924 compared with the preceding year were: The increased value of the petroleum yield, although there was a material decrease in quantity; decrease in cement value owing to lower prices, although increased amounts were manufactured; increases in copper, quicksilver, tungsten, granite, marble, miscellaneous stone, limestone, mineral water, potash, and salt; and decreases in natural gas, gold, silver, platinum, brick, magnesite, pottery clay, gypsum, pyrites, and borates. The net result was an increase in the grand total of all groups of nearly thirty-one million dollars, as stated above. Petroleum accounted for an increase of \$31,921,565 in total value in spite of a decrease of approximately 34,000,000 barrels in quantity.

Of the metals: Copper increased from 28,346,860 pounds worth \$4,166,989 to 52,089,349 pounds worth \$6,823,704; quicksilver from 5458 flasks and \$332,851 to 7948 flasks and \$543,080; and tungsten from 34 tons and \$19,126 to 781 tons and \$446,009. Gold decreased slightly from \$13,379,013 to \$13,150,175, in spite of which, as for several years past, California continued to account for approximately 30% of the gold output of the United States. Silver decreased in value from

\$2,918,743 to \$2,381,952, owing to a lower average price.

Of the structural group: Cement advanced in quantity from 10,825,405 barrels to 11,655,131 barrels, but due to foreign importations duty free, the price dropped, resulting in a decrease of total value from \$25,999,203 to \$23,225,850; granite increased from \$760,081 to \$1,211,046 in value, due to certain large building contracts notably the Los Angeles County Building; brick and hollow building blocks or tile decreased in total value from \$9,738,082 to \$9,137,908 owing mainly to a decrease in common brick. Lime and magnesite also registered decreases.

Of the 'industrial' group, as is usually the case, there were a number of fluctuations, the more important increases in value being shown by mineral water and limestone, and decreases in value by diatomaceous earth, pottery clay, gypsum, pyrites, and tale. Of the salines, borates

and soda showed decreases, while common salt, potash and magnesium

salts advanced in quantity and value.

The above-noted total value of California's mineral industries for 1924 exceeds by more than six million dollars the estimate of the State Department of Agriculture for the farm values of California's agricultural production in 1924 which was placed at \$368,427,000.

The economic importance of the mineral industries throughout the United States as a whole is evidenced by a statement² recently issued by the U. S. Department of Commerce concerning the freight handled by the railroads of the country, the products of mines representing 51.33 per cent of the whole. The various industries are represented as follows:

	Freight.
Industry	per cent
Agricultural productsAnimals and products	2.23
Forest products Manufacturers and miscellaneous	9.64
Mines—	26.17
Anthracite coal 5.68 Bituminous coal 28.45	
Iron ore 4.23	
Clay, sand, gravel, stone 8.67	
All other mineral products4.30	51.33
	91.00
Total	100.00

¹ Kaufman, E. E., Agricultural statistician, Cal. Co-op. Crop Reporting Section, State Dept. of Agr.; in Sacramento Bee, Jan. 10, 1925.

² Eng. & Min. Jour.-Press, Aug. 22, 1925, p. 304.

#### By Substances.

The distribution of the 1924 output of California by substances is shown in the following tabulation:

Substance	Amour	it	Value
Asbestos	70	tens	\$4,750
Bituminous rock	6,040	tons	14,922
Borates.	152,070	tons	1,599,149
Brick and tile			9,137,908
Cement	11,655,131		23,225,850
Chromite	350	tons	6,700
Clay (pottery)	417,928		651,857
Coal	1,425		8,800
Copper	52,089,349		6,823,704
Dolomite	28,843		71,271
Feldspar	9,055		68,112
Fuller's earth	5,290	tons	67,295
Gems			4,800
Gold			13,150,175
Granite			1,211,046
Gypsum	25,569		53,210
Lead	4,984,387		398,751
Lime	62,029		703,355
Limestone	219,476		582,660
Lithia		tons	2,269
Magnesite	67,236		900,183
Magnesium salts	4,823		145,883
Manganese ore	1,115		25,785
Marble (including Onyx and Travertine)			140,253
Mineral paint		tons	5,234
Mineral water	8,159,211	gals.	818,726
Natural gas	209,921,596	M. cu. ft.	15,153,140
Onyx and travertine (combined with Marble)			
Petroleum	228,933,471		274,652,874
Platinum		fine oz.	_36,452
Potash	33,107		747,407
Pumice and volcanic ash	4,919		33,404
Pyrites	124,214		517,835
Quicksilver		flasks	543,080
Salt	318,800		1,159,137
Sandstone		cu. ft.	3,600
Silica (sand and quartz)	6,808		35,006
Silver			2,381,952
Soapstone and tale	16,179		242,770
Soda	32,536	tons	711,796
Stone, miscellaneous ²			15,966,380
Tungsten concentrates		tons	446,009
Zinc	3,060,000	IDS.	198,900
Unapportioned ³			1,968,399
Total value			\$374,620,789

Recalculated to 40% 'anhydrous boric acid' equivalent.
 Includes macadam, ballast, rubble, riprap, paving blocks, sand, gravel and grinding-mill pebbles.
 Unapportioned—Includes aluminum sulphate, glauber salt, potash alum, arsenic, calcium chloride, diatomaceous earth, ircn ore, mica schist, shale oil, sillimanite-andalusite, sulphur, and radio galena crystals.

#### By Counties.

Distribution by counties is given in the following tabulation:

Alameda	\$2,634,645	Placer	492,180
Alpine	2,552	Plumas	3,876,105
Amador	2,938,865	Riverside	5,508,244
Butte	641,750	Sacramento	2,196,210
Calayeras	1,572,419	San Benito	
Colusa	77.267	San Bernardino	12,642,431
Contra Costa	2.348,090	San Diego	1,013,119
Del Norte	722,265	San Francisco	150,258
El Dorado	395,572	San Joaquin	
Fresno	12,547,798	San Luis Obispo	317,779
Glenn	41.550	San Mateo	302,171
Humboldt	485,478	Santa Barbara	5.159,740
Imperial	139,908	Santa Clara	1,150,401
Inyo	2,110,075	Santa Cruz	4,339,233
Kern		Shasta	4,754,664
Kings	725	Sierra	812,476
Lake	96.396	Siskiyou	140,787
Lassen	37,908	Solano	3,089,475
Los Angeles	168,420,709	Sonoma	172,051
Madera	955,469	Stanislaus	345,138
Marin	527,231	Sutter	
Mariposa	234,707	Tehama	34,454
Mendocino	60,768	Trinity	509,344
Merced	87,603	Tulare	498,674
Modoc	1,300	Tuolumne	629,156
Mono	126,691	Ventura	6,089,394
Monterey	286,490	Yolo	15,800
Napa	359,265	Yuba	2,189,881
Nevada	2,945,267	-	
Orange	40,481,210	Total	\$374,620,789

## Total Mineral Production of California, by Years.

The following tabulation gives the total value of mineral production of California by years since 1887, in which year compilation of such data by the State Mining Bureau began. At the side of these figures the writer has placed the values of the most important metal and non-

metal items—gold and petroleum.

In the same period copper made an important growth beginning with 1897 following the entry of the Shasta County mines, and more recently Plumas County. Cement increased rapidly from 1902, while crushed rock, sand and gravel as a group parallels the cement increase. Quick-silver has been up and down. Mineral water and salt have always been important items, but the values fluctuate. Borax has increased materially since 1896. War-time increases, 1915–1918, were shown by chromite, copper, lead, magnesite, manganese, silver, tungsten and zinc. Most of these, except silver, have since declined; with structural materials and copper increasing in 1920–1924; also lead and magnesite in 1923.

## Total Mineral Production of California by Years, Since 1887.

Year	Total value of all minerals	Gold, value	Petroleum, value
1887	\$19,785,868	\$13,588,614	\$1,357,144
1888	19,469,320	12,750,000	1,380,666
1889	16,681,731	11,212,913	368,048
1891	18,039,666 18,872,413	12,309,793 12,728,869	384,200 401,264
1892	18,300,168	12,725,809	561,333
1893	18,811,261	12,422,811	608,092
1894	20,203,294	13,923,281	1,064,521
1895	22,844,663	15,334,317	1,000,235
1896	24,291,398	17,181,562	1,180,793
1897	25,142,441	15,871,401	1,918,269
1898	27,289,079	15,906,478	2,376,420
1899	29,313,460 32,622,945	15,336,031 15.863.355	2,660,793 4,152,928
1900	34,355,981	16,989,044	2,961,102
1902	35,069,105	16,910,320	4,692,189
1903	37,759,040	16,471,264	7.313.271
1904	43,778,348	19,109,600	8,317,809
1905	43,069,227	19,197,043	9,007,820
1906	46,776,085	18,732,452	9,238,020
1907	55,697,949	16,727,928	16,783,943
1908	66,363,198 82,972,209	18,761,559 $20,237,870$	26,566,181 32,398,187
	88,419,079	19,715,440	37,689,542
1910	87,497,879	19,738,908	40,552,088
1912	89,972,385	19,713,478	41,868,344
1913	98,644,639	20,406,958	48,578,014
1914	93,314,773	20,653,496	47,487,109
1915	96,663,369	22,442,296	43,503,837
1916	127,901,610	21,410,741	57,421,334
1917	161,202,962	20,087,504	86,976,209
1918 1919	199,753,837	16,529,162	127,459,221
1920	195,830,002 242,099,667	16,695,955 14,311,043	142,610,563 178,394,937
1921	268,157,472	15,704.822	203.138.225
1922	245,183,826	14.670.346	173,381,265
1923	344,024,678	13,379,013	242,731,309
1924	374,620,789	13,150,175	274,652,874
Totals	\$3,470,395,816	\$628,747,742	\$1,883,138,099

#### BRICK AND TILE.

Bricks of many varieties and in important quantities are annually produced in California, as might be expected in a state with such diversified and widespread mineral resources. The varieties include common, fire, pressed, glazed, enamel, fancy, vitrified, sand-lime and others. So far as possible, the figures for the different kinds are segregated in the annual statistical bulletin of the State Mining Bureau. We also include under this heading the various forms of hollow building 'tile' or blocks, the use of which is increasing annually.

The values by counties in 1924 were distributed as follows:

County Brick and Tile Values, 1924.	Value
County	
Alameda	\$763,476
Contra Costa	327,225
Fresno	95,014
Los Angeles	5,484,987
Mendocino	7.125
Placer	186,053
Riverside	493,746
Cagramonto	290,213
Sacramento	232,113
San Diego	462,688
San Joaquin	35,987
San Luis Obispo	217.172
Santa Clara	411,114
Amador, Humboldt, Imperial, Kern, Marin, Merced, Orange, Santa Bar-	F 49 100
bara, Tehama, Tulare*	542,109
	00 40 000
Total value	\$9,1.37,908

^{*}Combined to conceal output of a single operator in each.

## CLAY (pottery).

In the statistical reports of the State Mining Bureau, 'pottery clay' refers to all clays used in the manufacture of red and brown earthenware, china and sanitary ware, flower-pots, floor, faience and ornamental tiling, architectural terra cotta, sewer pipe, drain and roofing tile, etc., and the figures for amount and value are relative to the crude material at the pit, without reference to whether the clay was sold in the crude form or was immediately used in the manufacture of any of the above finished products by the producer. So far as we have been able to segregate the data furnished us, the 'pottery clay' figures do not include material utilized in making brick and hollow building blocks.

During 1924, a total of 48 producers in 19 counties reported an output of 417,928 short tons of pottery elay, having a total value of \$651,857 f.o.b., rail-shipping point, for the crude material, as compared with the 1923 production of 376,863 tons worth \$697,841. This was distributed, by counties, as follows:

Pottery Clay in 1924.		
County	Tons	Value
Alameda	2,482	\$1,124
Amador	64,317	87,444
Los Angeles	84,065	132,855
Monterey	238	436
Placer	97,670	$146,508 \\ 166,692$
Riverside	$121,193 \\ 1.750$	4.470
SacramentoSan Diego		36.941
Santa Clara	5.341	5,666
Calaveras, Contra Costa, Humboldt, Kern, Marin, Merced		
Orange, San Bernardino, Santa Barbara, Tuolumne *	28,089	69,721
	417 928	\$651.857

^{*} Combined to conceal output of a single operator in each.

#### COAL.

Coal production in California in 1924 amounted to a total of 1425 short tons valued at \$8,800, being credited to Amador, Mendocino, Riverside, San Benito, Shasta, and Siskiyou counties. With the exception of a small tonnage marketed locally in Amador County, the above output was almost entirely consumed for camp purposes and for power and forge use in development work on deposits. The 1923 figures were 1010 tons and \$5,090, credited to Mendocino and Riverside counties.

## FELDSPAR.

Feldspar was produced by nine operators in two counties (Riverside and San Diego) during 1924, to the amount of 9055 tons, valued at \$68,112, being a slight decrease, both in quantity and value from the 1923 figures of 11,100 tons and \$81,800.

The product was used in the ceramic industry, principally in pottery, porcelain, enamel wares, also enamel brick and tile, being a constituent of both the body and the glaze, but more especially of the latter.

The most important developments in recent years in the feldspar resources of California have taken place in San Diego and Riverside counties where large deposits of massive, high-grade spar are being opened up.

12-42102

a Includes kaolin.
b Includes 'Cornwall stone.'

#### GRANITE.

The value of the granite output of California for 1924 was the highest recorded for any year since 1891, due mainly to the contract for the construction of the new Los Angeles County Building. Stone for 'monumental' and decorative purposes showed an increase in quantity but a decrease in total value. The net result was an increase in total value of the several groups from \$760,081 to \$1,211,046, segregated as follows:

Class	Amount	Value
Building stone	500 lin. ft.	\$819,972 360,659 1,500 28,915
Total value		\$1,211,046

The most important district is Madera County, followed in turn by San Diego, Fresno, and Tulare, with smaller amounts from Placer, Nevada, Plumas, Riverside and Sacramento. Some tuff from Inyo and Los Angeles counties, used for building stone, is included in the above.

#### LIME.

Lime to the amount of 62,029 tons, valued at \$703,355 was produced by 11 plants in eight counties during 1924, as compared with 70,894 tons, valued at \$788,834 in 1923. There were two plants each in Kern, San Bernardino, and Santa Cruz counties, and one each in El Dorado, Inyo, San Diego, Siskiyou, and Tuolumne.

So far as we have been able to segregate the data, these figures include mainly only such lime as is used in building operations; though they do include a small proportion of calcined lime employed in agriculture and the chemical industries, the figures for which were not separable. A portion is hydrated lime. Limestone utilized in sugar making, for smelter flux, as a fertilizer, and other industrial uses, is classified under 'Industrial Materials.' That consumed in cement manufacture is included in the value of cement.

#### LIMESTONE.

'Industrial' limestone was produced in 12 counties during 1924, to the amount of 219,476 tons, valued at \$582,660, being an increase both in quantity and value over the 1923 output of 143,266 tons worth \$348,464.

The amount here given does not include the limestone used in the manufacture of cement, nor for macadam and concrete, nor of lime for building purposes; but accounts for that utilized as a smelter and foundry flux, for glass and sugar making, and other special chemical and manufacturing processes. It also includes that utilized for fertilizers (agricultural 'lime'), 'roofing gravel,' paint and concrete filler, whiting for paint, putty, kalsomine, terrazzo, paving dust, chicken dust, chicken grit, carbon dioxide gas, 'paving compound', facing dust for concrete pipe, also for rubber and magnesite mix. Of the total product in 1924, approximately 24,000 tons valued at \$85,000 was used for agricultural purposes.

#### MANGANESE.

Manganese ore shipments in California in 1924 amounted to a total of 1115 tons of all grades, valued at \$25,785, being an increase both in quantity and value over the 1923 yield which totaled 690 tons and \$10,620 value. These ores showed analyses of from 46% to 59% Mn, and were utilized almost entirely by Pacific Coast steel plants for ferro-manganese.

Importations of foreign manganese ores in 1924, mainly from Brazil, amounted to a total of 255,157 long tons valued at \$6,084,686 compared with 206,048 long tons and \$3,874,510 in 1923. The Tariff Act of 1922 provides for an import duty of 1¢ per pound on the metallic manganese contained, for "manganese ore or concentrates containing in excess of 30 per centum of metallic manganese." The bulk of such ore is consumed in the large steel-producing centers of the eastern United States.

## MINERAL WATER.

Commercial production of mineral water in California for 1924 amounted to a total of 8,159,211 gallons valued at \$818,726, being an increase both in quantity and value over the high-record figures of 1923. The 1924 output was distributed by counties as follows:

## Mineral Water Production, by Counties, 1924.

County Butte Calaveras Lake Los Angeles Napa Riverside San Diego Sisklyou	78,560 107,097 300,500	Value \$4,500 139 59,423 88,942 53,391 23,021 26,100
Siskiyou Sonoma Colusa, Contra Costa, Humboldt, Marin, Monterey, Placer, San Benito, San Bernardino, San Luis Obispo, Santa Barbara,	31,003	8,002
Santa Clara, Solano*	5,605,338	566,566
Totals	8.159.211	\$818,726

^{*}Combined to conceal output of a single operator in each.

The production above tabulated was in part bottled with artificial carbonation, in part natural, and a large part was used in the preparation of soft drinks with flavors.

Although some of the operators complain that prohibition has all but killed off the mineral water business, the reports of the actual production of mineral water bottled and sold indicate an encouraging growth and a material increase annually both in total quantity and value.

#### NATURAL GAS.

There is rather a wide variation in prices quoted for natural gas because a considerable part is used directly in the fields for driving gas engines and firing boilers, and is therefore not measured nor sold. Such companies as have placed a valuation on their returns to the State Mining Bureau on the gas that was thus used in 1924 gave from  $3\phi$ -25 $\phi$  per 1000 cubic feet, at the well. From the totals shown in the tabulation below, the average value for all fields in 1924 works out at approximately 7.2 $\phi$ . Approximately 7000 cubic feet of gas is equal to

one barrel of oil in heating value, and is so accounted for by many operators. In driving gas engines about 4000 cubic feet per 24 hours are consumed by a 25-h.p engine, and 63,700 cubic feet per day for heating a 70-h.p. steam boiler, which figures have been utilized in compiling the tabulation below.

#### Natural Gas 'Consumed' or Utilized for Fuel, 1924.

County	M Cu. Ft.	Value
Fresno	1,430,708	\$102,286
Kern	47,881,308	2,522,551
Kings	1,480	725
Los Angeles	122,838,521	9,191,395
Orange	29,812,139	2,397,813
Santa Barbara	1,643,355	158,836
Tulare	1,080	540
Ventura	5,995,760	633,352
Butte, Humboldt, Lake, Mendocino, Sacramento, San		
Joaquin, San Luis Obispo, Sutter, Yuba*	317,245	145,642
	000000000000000000000000000000000000000	0.17.170.110
Totals	209,921,596	\$15,153,140

^{*}Combined to conceal output of a single operator in each

The above totals for 1924 compare with 240,405,397 M cubic feet valued at \$15,661,433 in 1923, which year was nearly  $2\frac{1}{2}$  times the quantity and more than double the value of 1922.

The 1923 total of quantity was approximately one-half of the previously recorded total for California for the years 1888–1922, inclusive; and the 1923 total of value equaled 41% of the total value for the same period. This was due to remarkable increases in the Los Angeles and Orange County fields. In 1924, the quantities of natural gas utilized in those two counties decreased; Kern and Ventura counties showed increases.

The compiled figures for 1924 received from two of the larger agencies handling natural gas and natural-gas gasoline, total somewhat higher than the aggregate of the data received direct by the State Mining Bureau from the separate plants and operators. Assuming that our list of operators may have lacked some names, from whom we thereby lacked returns, we have taken an average of these several sets of figures as the basis for the present report. Compared with 1923, there was a decrease in Los Angeles County in the amount of gas consumed, owing to the decline in oil production in the older of the new fields. There was an increase in gasoline recovered from natural gas because in the newest two fields (Rosecrans and Dominguez) there was a large flow of gas but no pipe-line facilities for conveying it to the consuming centers. In this case, the gasoline was 'squeezed' out of a portion and the dry gas blown into the air unconsumed.

#### PUMICE.

The production of pumice and volcanic ash for the year 1924 amounted to 4919 tons valued at \$33,404 and came from properties in Imperial, Inyo, and Kern counties. This is an increase both in tonnage and value over the 1922 shipments which totaled 2936 tons and \$16,309. The material from Imperial County is of the vesicular, block variety and was sold for abrasive purposes; that from Inyo and Kern is the volcanic ash, or tuff, variety and was employed in making soap and cleanser compounds.

#### SALT.

Most of the salt production in California is obtained by evaporating the water of the Pacific Ocean, plants being located on the shores of San Francisco, Monterey, and San Diego bays, and at Long Beach. Additional amounts are derived from lakes and lake beds (including some rock salt) in the desert regions, mainly in Kern and San Bernardino counties. A small amount of valuable medicinal salts is obtained by evaporation of the water of Mono Lake, Mono County.

Distribution of the 1924 production by counties was as follows:

County	Tons	Value
AlamedaKern	189,217 $10,506$	\$635,653 44,115
San Bernardino	29,699	99,791
San Mateo Los Angeles, Modoc, Mono, Monterey, San Diego*	$52,258 \\ 35,120$	$205,176 \\ 174,402$
Totals	318.800	\$1,159,137

aMedicinal salts.

The above returns show an increase both in tonnage and value over the 1923 figures, establishing a new high record for this industry in California. There were nine plants operating in Alameda County, and a total of twelve plants in the other counties tabulated, being an increase of three over the total number operated in 1923.

#### SANDSTONE.

An unlimited amount of high-grade sandstone is available in California, but the wide use of concrete in buildings of every character, as well as the popularity of lighter-colored building stones, has curtailed production during recent years almost to the vanishing point. In 1924 two counties—Monterey and Ventura—turned out 6700 cubic feet valued at \$3,600, compared with 7000 cubic feet and \$13,000 in 1923. The main feature of the loss since 1914 is the closing of the well-known Colusa quarries, on account of the competition of lighter-colored materials. The material reported from Monterey County in 1924 is in reality an indurated shale of the Monterey series, of a cream-color and utilized as a building stone.

## SILICA.

The production of silica (sand and lump quartz) in California in 1924 amounted to 6808 tons valued at \$35,006, from eight properties in four counties. We combine these materials because of the overlapping roles of vein quartz which is mined for use in glass making and as an abrasive, and that of silica sand which, although mainly utilized in glass manufacture, also serves as an abrasive. Both varieties are also utilized to some extent in fire-brick manufacture.

A portion of the tonnage of vein quartz in California is utilized as a foundry flux and for steel-casting moulds; and part of the 1924 output was used for roofing and stucco-dash granules. A portion of the silica sold (both sand and quartz) is also used in glazes for porcelain, pottery and tile, and in the body of the ware to diminish shrinkage; and some of the sand for the preparation of sodium silicate ('water-glass').

^{*}Combined to conceal output of a single operator in each.

## STONE (miscellaneous).

'Miscellaneous stone' is the designation used in the reports of the State Mining Bureau as the title for that branch of the mineral industry covering crushed rock of all kinds, paving blocks, sand and

gravel, and pebbles for grinding mills.

For the year 1924, crushed rock registered gains both in tonnage and value over the preceding year; but sand and gravel showed a slight decrease. The result was a net gain for the group, the 1924 total value being \$15,966,380 as compared with \$15,395,652 in 1923. Continuance of general building work and highway paving are in part responsible as well as hydro-electric power-plant installation and harbor

protection (breakwater and jetty construction).

As for some years past, Los Angeles County led all others by a wide margin with an output valued at \$5,923,329 (compared with \$5,408,808 in 1923); followed by Alameda, second, with \$1,158,886; Del Norte, third, \$721,720; Contra Costa, fourth, \$646,369; Sacramento, fifth, \$639,811; Shasta, sixth, \$587,637; Riverside, seventh, \$561,861; Orange, eighth, \$505,932; followed in turn by Humboldt, Fresno, San Diego, Marin, San Bernardino, San Benito, Napa, and Santa Clara, in the order named, each with a total between a half and a quarter-million dollars.

## Paving Blocks.

The paving block industry has decreased materially of recent years, almost to the vanishing point, because of the increased construction of smoother pavements demanded by motor-vehicle traffic. Shipments in 1924 amounted to only 11 M, valued at \$935.

# Grinding-Mill Pebbles.

Production of pebbles for tube and grinding mills began commercially in California in 1915. Shipments in 1924 totaled 434 tons, valued at \$2,969, a decrease from the 2650 tons and \$14,936 of 1923.

#### Sand and Gravel.

A considerable part of the gravel excavated is passed through grading and washing plants, and the material over 2 inches in size is crushed. Much of it is utilized in concrete mixtures. Most of the gravel used for road surfacing and repairs as well as that for railroad ballast is creek-run or pit-run material which is spread upon the roads without undergoing any grading or washing.

The distribution of the 1924 output of sand and gravel, by counties, is shown in the following table:

County	Tons	Value
Alameda	a1,262,095	\$809.818
Butte	80,000	45,500
Calaveras	86,124	56,000
Colusa	100,222	75,167
Contra Costa	a87,763	48,004
El Dorado	1,279	2.538
Fresno	376,779	262,722
Glenn	189,188	41.550
med a sale	233,626	
	400,040	190,109
	59,385	14,958
Kern	$15,345 \\ 33,337$	4,044
Lake		11,113
Lassen	240	100
Los Angeles	3,479,620	1,720,251
Mariposa	43,870	36,000
Merced	15,090	8,462
Mono	500	300
Monterey	b245,896	239,097
Napa	187,376	151,876
Nevada	30,262	22,200
Orange	516,900	405,932
Placer	17,433	10,753
Riverside	a14,300	14,500
Sacramento	a350.021	217.159
San Benito	52,688	26,111
San Bernardino	759,825	241,376
San Diego	a323,931	306,953
San Francisco	10,000	5,000
San Joaquin	155,547	79,504
San Mateo	47,671	28.589
Santa Barbara	66,004	45,777
Santa Clara	217,592	155,053
Santa Cruz	15,033	13,294
Shasta	177,265	197.078
	14,292	
Sierra	21,434	7,750
Siskiyou	21,600	16,000
Sonoma	164,932	69,556
Stanislaus	119,152	108,050
Tehama	16,435	15,694
Trinity	1,360	1,240
Tulare	5,000	8,000
Ventura	a177,454	113,763
Yuba Amador, Madera, Marin, Mendocino, Modoc, San Luis Obispo,	259,997	181,113
Amador, Madera, Marin, Mendocino, Modoc, San Luis Obispo,		
Solano, Yolo*	105,376	63,953
ETT A		
Totals	10,137,805	\$6,072,007

*Combined to conceal output of a single operator in each. *Includes molding sand.
bIncludes molding, blast, filter and roofing sand.

Included in the above is a total of 32,968 tons of molding sand, valued at \$68,105 f. o. b. pit, from two operators in San Diego County, and one each in Alameda, Contra Costa, Monterey, Riverside, Sacramento, and Ventura. This item is each year assuming a more important position in the commercial mineral list of California. The 1923 molding sand figures totaled 33,194 tons and \$66,634.

## Crushed Rock.

To list the kinds and varieties of rocks utilized commercially under this heading would be to run almost the entire gamut of the classification scale. Much depends on the kind available in a given district. In many localities, river-wash boulders form an important source of such material. In such cases, combined crushing and washing plants obtain varying amounts of sand and gravel along with the crushed sizes.

The values given are based upon the selling prices, f. o. b. cars.

barges, or trucks at the quarry,

Crushed Rock Production, by Counties, for 1924.

County	Macadam and Ballast	nd Ballast	Rubble and Riprap	d Riprap	Concrete	rete	Unclassified	sified	Totals	als
Samoo -	Tons	Value	Tons	Value	Tons	Value	Tons	Value	Tons	Value
Alameda	31,337	\$27,580	150	\$720	219,701	\$306,416	a24,634	\$14,352	275,822	\$349,068
Autre-	20,000	15,000	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				095,500	77,500	115,500	92,500
Cataveras. Contra Costa From	32,705	31,378	2,974	3,347	50,034	56,289	622,474 622,474 948,756	507,351	7,500	27,250 598,365 188,818
Humboldt Imperial Jake	76,286 1,500 5,860	166,340 1,500 11,720	d40,000 62,637	120,000	40,912	41,824	8,000	8,000	116,286 113,049 5,860	286,340 63,074 11,720
Løssen Los Angeles Marin	1,592,340	35,514	244,796	391,674	2,775,654	1,970,228	fa1,124,310 c8,250	827,233	42,330 5,737,100 8,250	35,514 4,203,078 6,500
Mariposa Mendocino	28,266	46,680					62,270	12,000	28,266	46,680
Mono. Napa. Placer	14,790 46,554 5,000	18,744 41,549 3,000	710	820	43,059	44,098	21,333	24,000	14,790 110,946 6,160	18,744 $109,647$ $4,820$
Riverside	80,621	51,201	6,143	3,378	50,452	52,542	h1,350 428,486	12,650 315,531	1,350	12,650 422,652 207,958
San Denito. San Pracisco. San Marteo.	1,200 30,345	500 500 600 30 214	3,744	4,712 60,529	41,673 1,400 13,466	45,460 1,000 15,150	41,333	18,500 83,129 1,125	87,750 107,867 44,477	69,172 145,258 46,489
Santa Clara. Sharta Cruz. Sierra.	10,000 6,924 96,417	7,500 5,322 146,090	2,442	2,748	5,000 * 161,529 500	3,000	124,626	93,470	139,626 6,924 260,388 500	103,970 5,322 390,559 250
Siskiyou Sonoma Tehama	62,731 25,395 10,327	51,787 26,042 10,260	61	46	3,637	5,365	1 1 1 C		62,731 29,093 10,460	51,787 31,453 10,360
francy Tulare Toolume Ventura.	39,356 2,100 26,000	29,729 1,500 34,000	6,769	1,062	15,000	20,000	300 h20,235 i k2,080 9,072	11,000 11,000 7,574	81,360 4,180 47,072	72,411 12,500 59,574
Amaou, Pen Norte, Inyo, Mercea, Iwasaa, Kiverside, Ean Luis Obispo, Saria Barbara, Solano* Del Norted, Madera, Marin, Riverside, San Bernardino, Santa Cruz*	373,806	443,978	496,171	736,274					373,806	443,978 736,274

Marin, Nevada, Orange, Riverside, San Benito. San Ber-	_	-	-	-			•			,
nardino, San Joaquin, Santa Cruz, Stanislaus*				1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	985,455	856,332		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	985,455	856,332
Dara, Dolano				1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		1	165,711	154,572	165,711	154.572
Totals	2,964,319	\$2,461,459	914,070	\$1,337,060	4.419.605	\$3.677.775	3 015 230	\$9 414 17E	11 219 994	90 800 400
						2011	0,0101010	W-, 111,110	17,010,014	604,080,80

*Combined to conceal output of a single operator in each.
Aincludes red shale, roofing granules.
bincludes red candstone roofing granules.
Findludes green stone for roofing and stuceo dash.
dincludes green stone up to 10-ton blocks for breakwater (jetty) construction.
eIncludes large stone up to 10-ton blocks for breakwater (jetty) construction.

Includes red roofing granules.
*Includes red and green roofing granules.
*Includes granite granules for roofing and stucco dash.
*Includes quartz granules for roofing.
*Includes marble granules for terrazzo.

## MUSEUM.

The Museum of the State Mining Bureau possesses an exceptionally fine collection of rocks and minerals of both economic and academic value. It ranks among the first five of such collections in North America; and contains not only specimens of most of the known minerals found in California, but much valuable and interesting material from other states and foreign countries as well.

Mineral specimens suitable for exhibit purposes are solicited, and their donation will be appreciated by the State Mining Bureau as well

as by those who utilize the facilities of the collection.

The exhibit is daily visited by engineers, students, business men, and prospectors, as well as tourists and mere sightseers. Besides its practical use in the economic development of California's mineral resources, the collection is a most valuable educational asset to the state and to San Francisco.

## LABORATORY.

FRANK SANBORN, Mineral Technologist.

During the past three months a few interesting samples of gold and silver ores have been received at the laboratory, proving that these

precious metals are still found in new prospects.

From Alpine County there recently was received a sample of rock that would by panning yield a heavy concentrate in small amounts. This concentrate resembled a ruby-like garnet in some respects. The prospector requested an identification of this mineral. This ruby-like mineral proved to be ruby silver, and the sample contained a gold value of nearly ten dollars per ton, although no gold was visible in panning. From the letter accompanying the sample, it would seem that the prospect was never before discovered, and it is possible that this prospect may develop into something of value.

From Calaveras County there was received also a sample of quartz containing considerable pyrite; this sample would show a small amount of free gold in panning, but an assay proved the ore to contain gold

values in excess of \$300 per ton.

From Inyo and other counties similar samples have been received. The prospectors in each case examined their pan concentrates carefully, and noticing minerals that would concentrate, had them identified.

There are undoubtedly many valuable gold and silver deposits still remaining undiscovered in some of our counties. The prospectors, who are good observers, will eventually find these prospects that will

develop into good producing mines.

During the three-month period covered by this report, 1083 samples were received and determined at the laboratory of the State Mining Bureau. The interesting counties of Inyo, Alpine, Mono, and San Bernardino appear to have fewer prospectors seeking veins of the precious metals—gold and silver—however. During recent months there has been a notable increase in the prospecting for valuable aluminum silicates and other nonmetallic minerals and a decided decrease in the search for gold and silver.

## LIBRARY.

FOREST L. CAMPBELL, Librarian.

In addition to the numerous standard works, authoritative information on many phases of the mining and mineral industry is constantly being issued in the form of reports and bulletins by various government agencies.

The library of the State Mining Bureau contains some five thousand selected volumes on mines, mining and allied subjects, and it is also a repository for reports and bulletins of the technical departments of federal and state governments and of educational institutions, both domestic and foreign.

It is not the dearth of the latter publications, but rather a lack of knowledge of just what has been published and where the reports may be consulted or obtained, that embarrasses the ordinary person seeking specific information.

To assist in making the public acquainted with this valuable source of current technical information, 'Mining in California' contains under this heading a list of all books and official reports and bulletins received.

with names of publishers or issuing departments.

Files of all the leading technical journals will be found in the library, and county and state maps, topographical sheets and geological folios. Current copies of local newspapers published in the mining centers of the State are available for reference.

The library and reading room are open to the public during the usual office hours, when the librarian may be freely called upon for all necessarv assistance.

#### OFFICIAL PUBLICATIONS RECEIVED.

#### Governmental.

U. S. Geological Survey:

Mineral Resources of the United States:

Bauxite and Aluminum in 1924.

Gold, silver, copper, lead, and zinc in New Mexico and Texas in 1923.

Fuller's Earth in 1924.

Peat in 1924.

Petroleum in 1924.

Summary Report of Mineral Resources in 1924.

Cadmium in 1923-1924.

Quicksilver in 1924.

Tin in 1924.

Bulletin No. 781-A—Paleozoic Formations Penetrated by Wells in Tishomingo County, Northeastern Mississippi. By M. N. Bramlette. Bulletin No. 766—Spirit Leveling in California, 1876–1923.

Birdseye.

Bulletin 773-E-Geology and Gold Placers of the Chandalar District, Alaska. By J. B. Mertie, Jr.

Water Supply Paper No. 545—Hudson Bay and Upper Mississippi River

Water Supply Paper No. 529—Part IX, Colorado River Basin.

Water Supply Paper No. 499-The Papago Country, Arizona. Bryan.

U. S. Bureau of Mines:

Bulletin No. 235—Mine Timber, Its Selection, Storage, Treatment and Use. By R. R. Horner.

Bulletin No. 222—The Metallurgy of Quicksilver. By L. H. Duschak.

Bulletin No. 231—Investigation of Toxic Gases from Mexican and Other High Sulphur Petroleums and Products.

Bulletin No. 237—Tests of a Large Boiler Fired with Powdered Coal.

Bulletin No. 247—Sources of Limestone, Gypsum and Anhydrite for Dusting Coal Mines to Prevent Explosions.

Technical Paper No. 373-The Pyrotannic Acid Method for the Quantitative Determination of Carbon Monoxide in Blood and in Air. By R. R. Sayers. Reports of Investigation:

Serial No. 2693—Coal-Mine Fatalities in May, 1925. By W. W. Adams.

Serial No. 2694—Present Trend in Flotation Flow-Sheets and Classifica-

tion of Flotation Feed. By A. W. Fahrenwald. Serial No. 2695—Additions, Removals and Changes, in Permissible List of Explosives, from January 1, 1925, to June 30, 1925. By J. E. Crawshaw. Serial No. 2696—Consumption of Explosives in May, 1925. Adams.

Serial No. 2697—Methods of Increasing Lump-Coal Production, with Especial Reference to Southern Illinois. By W. E. Tiffany and J. J. McKitterick.

Serial No. 2698—Barium Polysulphide in Sulphidizing Oxide Ores for Flotation. By E. S. Leaver and H. M. Lawrence.

Serial No. 2699—Coal-Mine Fatalities in June, 1925. By W. W. Adams.

Serial No. 2700—Present Status of Differential Flotation. Fahrenwald.

Serial No. 2701—Consumption of Explosives, June, 1925. Adams.

Serial No. 2702—Coal-Mine Fatalities in July, 1925. By W. W. Adams.

Serial No. 2703—Twelfth Semi-Annual Motor Gasoline Survey. By I. N. Beall, H. M. Thorne and John Devine.

Serial No. 2704—Welfare and Safety in Connection with Mining in Utah. By Dr. A. L. Murray.

Serial No. 2705—Calcium-Sulphate Retarders for Portland Cement. By Ernest E. Berger.

Serial No. 2706—Consumption of Explosives in July, 1925. By W. W. Adams.

Serial No. 2707—Coal-Mine Fatalities in August, 1925. By W. W. Adams. Serial No. 2708—Miscellaneous Analyses of Foreign Coals.

U. S. Coast and Geodetic Survey. Magnetic Declination in North Carolina in 1925.

U. S. Department of Agriculture. Soil Survey of Tucker County, West Virginia. By S. W. Phillips.

Alabama Geological Survey. Bulletin No. 29—Statistics of the Mineral Production of Alabama for 1923.

California Bureau of Labor Statistics. 21st Biennial Report, 1923-1924.

California Department of Public Works. Report of the Division of Engineering and Irrigation of the State of California to Accompany the Second Biennial Report, Nov. 30, 1924.

Colorado Bureau of Mines. Annual Report for 1924.

Illinois State Geological Survey. Bulletin No. 28-Preliminary Report on Coal Stripping Possibilities in Illinois. By H. E. Culver.

Michigan Geological Survey. Production and Value of Mineral Products in Michigan for 1923 and Prior Years.

Nebraska State Museum:

Bulletin No. 1—A Preliminary Report of the Nebraska State Museum.

Bulletin No. 2—Elephas Scotti—A New Primitive Mammoth from Nebraska. Bulletin No. 3—Prosthennops Xiphodonticus—A New Fossil Peccary from Nebraska.

Bulletin No. 4—An American Fossil Giraffe.

Bulletin No. 5-Manganese Fulgarites.

Bulletin No. 6-Notes on Nebraska Fulgarites. By E. H. Barbour.

Bulletin No. 7—Sand Fulgarities from Nebraska. By A. E. Anderson. Tennessee Division of Geology. Bulletin No. 35—Administrative Report of the State Geologist, 1923 to 1924.

Virginia Geological Survey. Bulletin No. 11—The Physiography of the Upper James River Basin in Virginia. By F. J. Wright.

Australia, Commonwealth of:

Report of Petroleum Investigations Made in New South Wales.

The Possibility of Oil Discovery in Queensland.

Canada Department of Mines:

Geological Survey Summary Report, 1924, Part A.

Bituminous Sands of Northern Alberta-Sidney. By C. Ells.

Ontario Department of Mines:

Vol. XXXIII, Part VI, 1924. Vol. XXXIII, Part VII, 1924.

Bulletin No. 51—Preliminary Report on the Mineral Production of Ontario in 1923.

Bulletin No. 53—Preliminary Report on the Mineral Production of Ontario in 1924.

Press Bulletin-Mineral Production of Ontario, Jan. 1 to June 30, 1925.

32d Annual Report of the Ontario Department of Mines, Part I, 1923, Part IV, 1923.

Scientific and Industrial Research Council of Alberta. Fifth Annual Report. Finlands, Commission Geologique de:

No. 72—Das Gebiet Der Alkaligesteine von Kulajarvi in Nordfinnland. By Victor Hackman.

No. 73—Uber das Jotnische Gebiet von Satakunta. By A. Laitakari.

Great Britain, Geological Survey of:

Vol. XXX—Copper Ores of the Midlands Wales, the Lake District and the Isle of Man.

Summary of Progress of the Geological Survey of Great Britain and the Museum of Practical Geology for 1924.

Japan, Tohoku Imperial University, Sendai. Vol. VII, No. 3, Second Series (Geology).

Japan Imperial University. Journal of the Faculty of Science. Vol. I, Part I.

Queensland, Royal Society of: Proceedings of, for 1925, Vol. XXXVI. Russia Institute of Economic Mineralogy and Petrigraphy, Transactions of:

No. 49—Recent Problems in Working Colored and Precious Stones. By A. Fersman.

No. 61-The Carbon Scrap Process. By G. L. Sakharoff.

No. 66—The Mineral Composition of the Skeletons of Some Invertebrates from Barents and Kara Seas. By J. V. Samol.

No. 73-On the Obtainment of Sodium Chromate. By N. F. Joushvith.

No. 74—The Deposits of the Radium Ore in the Fergana District. By A. E. Fersman,

No. 77—The Natural Iron Dyes. By I. Kourbatoff.

No. 86—The Investigation of Kolchoeg-Alumin.

No. 88—A Sketch of the Localities of Colored Stones in Southeast Transbaikal District. By P. P. Soustzinsky.

No. 90—The Genetic Relations of Deposits of Ore in the Krivoy Rog. By P. Piatnitsky.

No. 92—Deposits of Silica of Organic Origin. By J. V. Samol.

Sweden, The University of. Vol. XVII—The Trilobites of the Leptaena Limestone in Dalarne. By Elsa Warburg.

Uruguay, Institute de Geologia and Perforaciones. Boletin 7—Las Esquestos Bituminosos de Cerro Largo y Los Ensayos Practicados en el Laboratorio del Instituto en 1917. By J. Wanters.

#### Societies and Educational Institutions.

California, University of:

Vol. 15, No. 11—A Contribution to the Paleontology of the Martinez Eocene of California. By R. N. Nelson.

No. 10—Geology of the Hydrographic Basin of the Upper Santa Ynez River, California. By R. N. Nelson.

Missouri School of Mines and Metallurgy. Vol. 8, No. 1—Reduction of Zinc Oxide by Carbon. By G. A. Zoller.

University of Missouri:

A Treatise on Missouri Clays.

A Study of Reinforced Concrete Dams. By Elmo G. Harris.

American Philosophical Society. Vol. LXIV, No. 2.

Mining and Metallurgical Society of America:

Bulletin No. 175-Report of the Subcommittee on Vanadium.

Bulletin No. 176—Special Report on Supply, Consumption and Stocks of Petroleum (Crude and Refined) in the United States,

Bulletin No. 177—Progress Report of the Committee on Antimony and the Committee on Foreign and Domestic Mining Policy.

Bulletin No. 178—Report of the Subcommittee on Tungsten.

Officers, Members and Committees.

Smithsonian Institution, The-Annual Report, 1923.

U. S. National Museum, Proceedings of the-Vol. 65.

## Topographic Maps.

Alaska, 17 by 24 inches. Aransas Pass, Texas. Belmont, New York. Cub Run, Kentucky. Herscher, Illinois. Irasburg, Vermont. Lanai, Hawaii. Leitchfield, Kentucky. Acord Lakes, Utah. Altenburg, Mo.-Ill. Attean, Maine. Buck Hill, Texas. Cambridge Springs, Pa. Carlinville, Ill. Castle Dale, Utah. Corpus Christi, Texas. Danville, Va.-N. C. Delaware, Ohio. Elgin, Ill. Sunland, Cal.

Burris Park, Cal. Lethent, Cal. Maysville, Mo. Peterstown, W. Va.-Va. Pilot Knob, Colo. Plattsburg Mo. Quincy, Ill.-Mo. Raymond, Illinois. Taylorville, Illinois. Gower, Mo. Harrisburg, Ill. Hiawatha, Utah. Lobelia, W. Va. Marlinton, W. Va. Oso Creek, Texas. Robstown, Texas. Sawtelle, Cal. Scofield, Utah. Spring Lick, Ky.

## Current Magazines on File.

For the convenience of persons wishing to consult the technical magazines in the reading room, a list of those on file is appended:

American Petroleum Institute, New York.

Architect and Engineer, San Francisco.

Arizona Mining Journal, Phoenix, Arizona.

Asbestos, Philadelphia, Pennsylvania.

Brick and Clay Record, Chicago.

Bulletin, Union Oil Co., Los Angeles.

California Journal of Development, San Francisco.

Cement, Mill and Quarry, Chicago, Illinois.

Chemical Engineering and Mining Review, London, England.

Engineering and Mining Journal-Press, New York.

Explosives Engineer, Wilmington, Del.

Financial Insurance News, Los Angeles, California.

Graphite, Jersey City.

Journal of Electricity and Western Industry, San Francisco.

Metallurgical and Chemical Engineering, New York,

Mine and Quarry, Chicago.

Mining and Engineering Record, Vancouver, B. C.

Mining and Oil Bulletin, Los Angeles.

Oil Age, Los Angeles.

Oil and Gas Journal, Tulsa, Oklahoma,

Oil and Gas News, Kansas City.

Oil News, Galesburg, Illinois.

Uildom, New York.

Oil, Paint and Drug Reporter, New York. Oil Trade Journal, New York. Oil Weekly, Houston, Texas.

Petroleum Age, New York.

Petroleum Record, Los Angeles. Petroleum World, Los Angeles.

Queensland Government Mining Journal, Brisbane, Australia.

Rock Products, Chicago, Illinois.

Safety News, Industrial Accident Commission, San Francisco.

Salt Lake Mining Review, Salt Lake City, Utah.

Southwest Builder and Contractor, Los Angeles. Standard Oil Bulletin, San Francisco.

Stone, New York.

The Record, Associated Oil Company, San Francisco.

Through the Ages, Baltimore.

## Newspapers.

The following papers are received and kept on file in the library:

Amador Dispatch, Jackson, Cal.

Arkansas Oil and Mineral News, Hot Springs National Park (Arkansas).

Barstow Printer, Barstow, Cal.

Blythe Herald, Blythe, Cal.

Bridgeport Chronicle-Union, Bridgeport, Mono Co., Cal.

Calaveras Prospect, San Andreas, Cal.

California Oil World, Los Angeles, Cal.

Cloverdale Reveille, Cloverdale, Cal.

Colusa Daily Sun, Colusa, Cal. Daily Commercial News, San Francisco, Cal.

Daily Midway Driller, Taft, Cal.

Del Norte Triplicate, Crescent City, Cal.

Exeter Sun, Exeter, Cal.

Gateway Gazette, Beaumont, Cal.

Goldfield News, Goldfield, Nevada.

Guerneville Times, Guerneville, Cal.

Healdsburg Enterprise, Healdsburg, Cal.

Humboldt Standard, Eureka, Cal.

Inyo Independent, Independence, Cal.

Inyo Register, Bishop, Cal.

Ione Valley Echo, Ione, Cal. Lake County Bee, Lakeport, Cal.

Mining and Financial Record, Denver, Colo.

Mining Topics, San Francisco, Cal.

Mountain Democrat, Placerville, Cal.

Mountain Messenger, Downieville, Cal. Nevada Mining Press, Reno, Nevada.

Oatman Mining News, Oatman, Arizona.

Oregon Observer, Grants Pass, Oregon.

Oroville Daily Register, Oroville, Cal. Petroleum Reporter, Taft, Cal.

Placer Herald, Auburn, Cal.

Plumas Independent, Quincy, Cal.

Plumas National Bulletin, Quincy, Cal.

Randsburg Times, Randsburg, Cal. San Diego News, San Diego, Cal.

Shasta Courier, Redding, Cal. Siskiyou News, Yreka, Cal.

Stockton Record, Stockton, Cal.

Tuolumne Prospector, Tuolumne, Cal.

Ventura Daily Post, Ventura, Cal.

Weekly Trinity Journal, Weaverville, Cal.

Western Sentinel, Etna Mills, Cal.

## PRODUCERS AND CONSUMERS.

The producer and consumer of mineral products are mutually dependent upon each other for their prosperity, and one of the most direct aids rendered by the Bureau to the mining industry in the past has been that of bringing producers and consumers into direct touch with each other.

This work has been carried on largely by correspondence, supplemented by personal consultation. Lists of buyers of all the commercial minerals produced in California have been made available to producers upon request, and likewise the owners of undeveloped deposits of various minerals, and producers of them, have been made known to those looking for raw mineral products.

When the publication of MINING IN CALIFORNIA was on a monthly basis, current inquiries from buyers and sellers were summarized and lists of mineral products or deposits 'wanted' or 'for sale' included in

each issue.

It is important that inquiries of this nature reach the mining public as soon as possible and in order to avoid the delay incident to the present quarterly publication of MINING IN CALIFORNIA, these lists are now issued monthly in the form of a mimeographed sheet under the title of 'Commercial Mineral Notes.'

## EMPLOYMENT SERVICE.

Following the establishment of the Mining Division branch offices in 1919, a free technical employment service was offered as a mutual aid to mine operators and technical men for the general benefit of the mineral industry.

Briefly summarized, men desiring positions are registered, the cards containing an outline of the applicant's qualifications, position wanted. salary desired, etc., and as notices of 'positions open' are received, the names and addresses of all applicants deemed qualified are sent to the prospective employer for direct negotiations.

Telephone and telegraphic communications are also given immediate

attention.

The Bureau registers technical men, or those qualified for supervisory positions, and vacancies of like nature, only, as no attempt will be made

to supply common mine and mill labor.

A list of current applications for positions and 'positions open' is carried in each issue. Notices are designated by a key number, and the name and address corresponding to any number will be supplied upon request, without delay or charge of any kind. If desired, recommendations may be filed with an application, but copies only should be sent to the Bureau, to avoid possible loss. Registration cards for the use of both prospective employers and employees may be obtained at any office of the Bureau upon request, and a cordial invitation is extended to the industry to make free use of the facilities afforded:

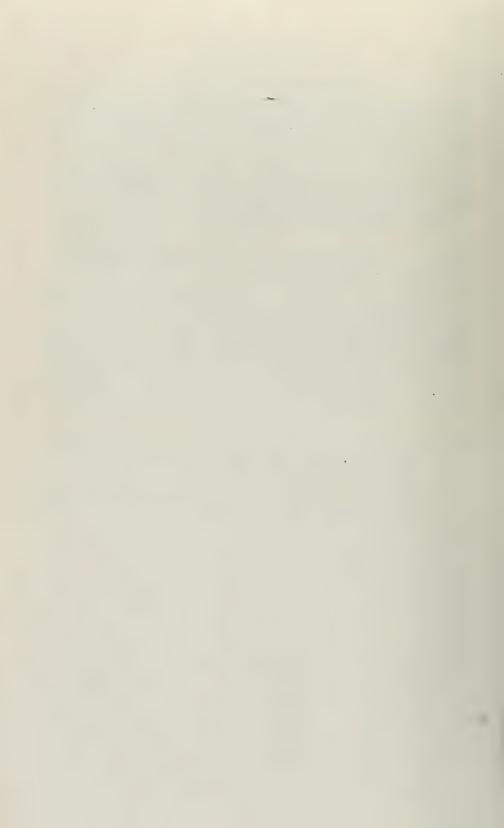
## POSITIONS WANTED.

Field geology or topographic work. Eighteen months' experience, geological, 31-21 mapping, etc. Age 26. Single. References. Salary open.
Field geology or topographic work. Experience as instrument man. Age 21.

31 - 22

Single. References. Salary open.

Superintendent or manager. Twenty-one years' experience as superintendent 31 - 23and manager at large copper and zinc mines, and general exploration work. Age 43. Married. References. Salary open.



# PUBLICATIONS OF THE CALIFORNIA STATE MINING BUREAU.

During the past forty-four years, in carrying out the provisions of the organic act creating the California State Mining Bureau, there have been published many reports, bulletins and maps which go to make up a library of detailed information on the mineral industry of the state, a large part of which could not be duplicated from any other source.

One feature that has added to the popularity of the publications is that many of them have been distributed without cost to the public, and even the more elaborate ones have been sold at a price which barely covers the cost of printing.

Owing to the fact that funds for the advancing of the work of this department have often been limited, many of the reports and bulletins mentioned were printed in limited editions which are now entirely

exhausted.

Copies of such publications are available, however, in the Bureau's offices in the Ferry Building, San Francisco; Sun Finance Building, Los Angeles; Chamber of Commerce Building, Sacramento; Santa Maria; Santa Paula; Coalinga; Taft; Bakersfield. They may also be found in many public, private and technical libraries in California and other states, and foreign countries.

A catalog of all publications of the Bureau, from 1880 to 1917,

giving a synopsis of their contents, is issued as Bulletin No. 77.

Publications in stock may be obtained by addressing any of the offices of the State Mining Bureau and enclosing the requisite amount in the case of publications that have a list price. The Bureau is authorized to receive only coin, stamps or money orders, and it will be appreciated if remittance is made in this manner rather than by personal check.

The prices noted include delivery charges to all parts of the United States. Money orders should be made payable to the State Mining

Bureau.

## REPORTS.

Asterisks (**) indicate the publication is out of print.	Price
**First Annual Report of the State Mineralogist, 1880, 43 pp. Henry G.	11100
**Second Annual Report of the State Mineralogist, 1882, 514 pp., 4 illustra-	
**Third Annual Report of the State Mineralogist, 1883, 111 pp., 21 illustra-	
**Fourth Annual Report of the State Mineralogist, 1884, 410 pp., 7 illustra-	
tions. Henry G. Hanks	
tions, 1 geological map. Henry G. Hanks**Sixth Annual Report of the State Mineralogist, Part I, 1886, 145 pp., 3	
illustrations, 1 map. Henry G. Hanks**Part II, 1887, 222 pp., 36 illustrations. William Irelan, Jr	
**Seventh Annual Report of the State Mineralogist, 1887, 315 pp. William Irelan, Jr.	
**Eighth Annual Report of the State Mineralogist, 1888, 948 pp., 122 illustra-	
**Ninth Annual Report of the State Mineralogist, 1889, 352 pp., 57 illustrations, 2 maps, William Irelan, Jr.	
tions, a maps: "Timum ricitin, bi	

# REPORTS-Continued.

Asterisks (**) indicate the publication is out of print.	-
**Tenth Annual Report of the State Mineralogist, 1890, 983 pp., 179 illustra-	Price
tions, 10 maps. William Irelan, Jr.	
Eleventh Report (First Biennial) of the State Mineralogist, for the two years ending September 15, 1892, 612 pp., 73 illustrations, 4 maps.	
William Irelan, Jr.	\$1.00
**Twelfth Report (Second Biennial) of the State Mineralogist, for the two	φ1.00
years ending September 15, 1894, 541 pp., 101 illustrations, 5 maps.	
J. J. Crawford	
**Thirteenth Report (Third Biennial) of the State Mineralogist, for the two years ending September 15, 1896, 726 pp., 93 illustrations, 1 map.	
J. J. Crawford	
Chapters of the State Mineralogist's Report, Biennial Period, 1913-1914,	
Fletcher Hamilton:	
**Mines and Mineral Resources, Amador, Calaveras and Tuolumne Counties,	
Mines and Mineral Resources, Colusa, Glenn, Lake, Marin, Napa, Solano,	
Sonoma and Yolo Counties, 208 pp., paper	.50
Mines and Mineral Resources, Del Norte, Humboldt, and Mendocino	
Counties, 59 pp., paper	.25
**Mines and Mineral Resources, Fresno, Kern, Kings, Madera, Mariposa, Merced, San Joaquin and Stanislaus Counties, 220 pages, paper	
Mines and Mineral Resources of Imperial and San Diego Counties,	
113 pp., paper	.35
**Mines and Mineral Resources, Shasta, Siskiyou and Trinity Counties,	
180 pp., paperFourteenth Report of the State Mineralogist, for the Biennial Period 1913-	
1914, Fletcher Hamilton, 1915:	
A General Report on the Mines and Mineral Resources of Amador, Cala-	
veras, Tuolumne, Colusa, Glenn, Lake, Marin, Napa, Solano, Sonoma,	
Yolo, Del Norte, Humboldt, Mendocino, Fresno, Kern. Kings, Madera, Mariposa, Merced, San Joaquin, Stanislaus, San Diego, Imperial,	
Shasta, Siskiyou, and Trinity Counties, 974 pp., 275 illustrations,	
cloth	-2.00
Chapters of the State Mineralogist's Report, Biennial Period, 1915-1916,	
Fletcher Hamilton: **Mines and Mineral Resources, Alpine, Inyo and Mono Counties, 176 pp.,	
paperpaper	
**Mines and Mineral Resources, Butte, Lassen, Modoc, Sutter, and Tehama	
Counties, 91 pp., paper	
Mines and Mineral Resources, El Dorado, Placer, Sacramento, and Yuba	.65
Counties, 198 pp., paper Mines and Mineral Resources, Monterey, San Benito, San Luis Obispo,	,00
Santa Barbara, and Ventura Counties, 183 pp., paper	.65
Mines and Mineral Resources, Los Angeles, Orange, and Riverside Counties,	
136 pp., paper	.50
**Mines and Mineral Resources, San Bernardino and Tulare Counties, 186 pp.,	
paper Fifteenth Report of the State Mineralogist, for the Biennial Period 1915–	
1916, Fletcher Hamilton, 1917:	
A General Report on the Mines and Mineral Resources of Alpine, Inyo,	
Mono, Butte, Lassen, Modoc, Sutter, Tehama, Placer, Sacramento,	
Yuba, Los Angeles, Orange, Riverside, San Benito, San Luis Obispo, Santa Barbara, Ventura, San Bernardino and Tulare Counties, 990 pp.,	
413 illustrations, cloth	3.75
Chapters of the State Mineralogist's Report, Biennial Period 1917-1918,	
Fletcher Hamilton:	.75
Mines and Mineral Resources of Nevada County, 270 pp., paper Mines and Mineral Resources of Plumas County, 188 pp., paper	.50
Mines and Mineral Resources of Sierra County, 166 pp., paper	.50
Seventeenth Report of the State Mineralogist, 1920, Mining in California during 1920, Fletcher Hamilton; 562 pp., 71 illustrations, cloth	
during 1920, Fletcher Hamilton; 562 pp., 71 illustrations, cloth	-1.75

## REPORTS-Continued.

REPORTS—Continued.	
Asterisks (**) indicate the publication is out of print.	Touris .
Eighteenth Report of the State Mineralogist, 1922, Mining in California, Fletcher Hamilton. Chapters published monthly beginning with Jan-	Price
uary, 1922:  **January, **February, March, April, May, June, July, August, September, October, November, December, 1922 Chapters of Nineteenth Report of the State Mineralogist, 'Mining in California,'	Free
Fletcher Hamilton and Lloyd L. Root. January, February, March, September, 1923	Free
Chapters of Twentieth Report of the State Mineralogist, 'Mining in California,' Lloyd L. Root. Published quarterly. January, April, July, October, 1924, per copy	\$0.25
Chapters of Twenty-first Report of the State Mineralogist, 'Mining in California,' Lloyd L. Root. Published quarterly, January, April, July, October, 1925, per copy	.25
Subscription, \$1.00 in advance (by calendar year, only).  Chapters of State Oil and Gas Supervisor's Report:	
Summary of Operations—California Oil Fields, July, 1918, to March, 1919 (one volume)	Free
Summary of Operations—California Oil Fields. Published monthly, beginning April, 1919:	
**April. **May, June. **July. **August. **September. **October, November.	Free
**December, 1919	Free
January, **February, **March, **April, May, June, **July, August,  **Santambar, **October, **November, **December, 1921	Free
January, **February, **March, **April, May, June, **July, August, **September, **October, **November, **December, 1921 January, February, March, April, May, June, July, August, September,	
January, February, March, April, May, June, July, August, September,	Free
October, November, December, 1923	Free
October, November, December, 1924	Free Free
BULLETINS.	
Asterisks (**) indicate the publication is out of print.	
**Bulletin No. 1. A Description of Some Desiccated Human Remains, by	
**Bulletin No. 2. Methods of Mine Timbering, by W. H. Storms. 1894, 58 pp., 75 illustrations	
**Bulletin No. 3. Gas and Petroleum Yielding Formations of Central Valley of California, by W. L. Watts. 1894, 100 pp., 13 illustrations, 4 maps.	
**Bulletin No. 4. Catalogue of Californian Fossils, by J. G. Cooper, 1894, 73 pp., 67 illustrations. (Part I was published in the Seventh Annual	~~
Report of the State Mineralogist, 1887.) **Bulletin No. 5. The Cyanide Process, 1894, by Dr. A. Scheidel. 140 pp.,	
46 illustrations  Bulletin No. 6. California Gold Mill Practices, 1895, by E. B. Preston,	
85 pp., 46 illustrations  **Bulletin No. 7. Mineral Production of California, by Counties for the	.50
year 1894, by Charles G. Yale. Tabulated sheet  **Bulletin No. 8. Mineral Production of California, by Counties for the year 1895, by Charles G. Yale. Tabulated sheet	
**Bulletin No. 9. Mine Drainage, Pumps, etc., by Hans C. Behr. 1896,	
210 pp., 206 illustrations	
Mineral Resources of California, by Anthony W. Vogdes. 1896, 121 pp. **Bulletin No. 11. Oil and Gas Yielding Formations of Los Angeles, Ventura and Santa Barbara counties, by W. L. Watts. 1897, 94 pp., 6 maps,	
31 illustrations	~

# BULLETINS—Continued.

Asterisks (**) indicate the publication is out of print.	
**Bulletin No. 12. Mineral Production of California, by Counties for 1896,	Price
by Charles G. Yale. Tabulated sheet	
**Bulletin No. 13. Mineral Production of California, by Counties for 1897,	
by Charles G. Yale. Tabulated sheet*Bulletin No. 14. Mineral Production of California, by Counties for 1898,	
by Charles G. Yale	
**Bulletin No. 15. Map of Oil City Fields, Fresno County, by John H.	
Means. 1899  **Bulletin No. 16. The Genesis of Petroleum and Asphaltum in California,	
by A. S. Cooper. 1899, 39 pp., 29 illustrations	
**Bulletin No. 17. Mineral Production of California, by Counties for 1899,	
by Charles G. Yale. Tabulated sheet*Bulletin No. 18. Mother Lode Region of California, by W. H. Storms.	
1900, 154 pp., 49 illustrations	
**Bulletin No. 19. Oil and Gas Yielding Formations of California, by W. L. Watts. 1900, 236 pp., 60 illustrations, 8 maps	
**Bulletin No. 20. Synopsis of General Report of State Mining Bureau, by	000 mm usu sa
W. L. Watts. 1901, 21 pp. This bulletin contains a brief statement	
of the progress of the mineral industry in California for the four years ending December, 1899	
**Bulletin No. 21. Mineral Production of California by Counties, by Charles	
G. Yale, 1900. Tabulated sheet	
**Bulletin No. 22. Mineral Production of California for Fourteen Years, by Charles G. Yale. 1900. Tabulated sheet	
Bulletin No. 23. The Copper Resources of California, by P. C. DuBois,	
F. M. Anderson, J. H. Tibbits and G. A. Tweedy. 1902, 282 pp., 69	&0 E0
**Bulletin No. 24. The Saline Deposits of California, by G. E. Bailey. 1902,	\$0.50
216 pp., 99 illustrations, 5 maps	
**Bulletin No. 25. Mineral Production of California, by Counties, for 1901, by Charles G. Yale, Tabulated sheet	
**Bulletin No. 26. Mineral Production of California for the past Fifteen	
Years, by Charles G. Yale. 1902. Tabulated sheet	Special State State Spine
**Bulletin No. 27. The Quicksilver Resources of California, by William Forstner. 1903, 273 pp., 144 illustrations, 8 maps	
**Bulletin No. 28. Mineral Production of California, for 1902, by Charles	
G. Yale. Tabulated sheet*Bulletin No. 29. Mineral Production of California for Sixteen Years, by	
**Bulletin No. 29. Mineral Production of California for Sixteen Years, by Charles G. Yale. 1903. Tabulated sheet	
**Bulletin No. 30. Bibliography Relating to the Geology, Palæontology, and	
Mineral Resources of California, by A. W. Vogdes. 1903, 290 pp**Bulletin No. 31. Chemical Analyses of California Petroleum, by H. N.	
Cooper. 1904. Tabulated sheet.	
**Bulletin No. 32. Production and Use of Petroleum in California, by Paul	
W. Prutzman. 1904, 230 pp., 116 illustrations, 14 maps**Bulletin No. 33. Mineral Production of California, by Counties, for 1903,	
by Charles G. Yale. Tabulated sheet.	
**Bulletin No. 34. Mineral Production of California for Seventeen Years, by Charles G. Yale. 1904. Tabulated sheet	
**Bulletin No. 35. Mines and Minerals of California, by Charles G. Yale.	
1904, 55 pp., 20 county maps. Relief map of California.	
**Bulletin No. 36. Gold Dredging in California, by J. E. Doolittle. 1905, 120 pp., 66 illustrations, 3 maps	
**Bulletin No. 37. Gems, Jewelers' Materials, and Ornamental Stones of	
California, by George F. Kunz. 1905, 168 pp., 54 illustrations**Bulletin No. 38. Structural and Industrial Materials of California, by	
Wm, Forstner, T. C. Hopkins, C. Naramore and L. H. Eddy. 1906,	
412 pp., 150 illustrations, 1 map	
**Bulletin No. 39. Mineral Production of California, by Counties, for 1904, by Charles G. Yale. Tabulated sheet	
**Bulletin No. 40. Mineral Production of California for Eighteen Years,	
by Charles G. Yale. 1905. Tabulated sheet	

#### BULLETINS—Continued.

Asterisks (**) indicate the publication is out of print.	
**Bulletin No. 41. Mines and Minerals of California, for 1904, by Charles	Price
G. Yale. 1905, 54 pp., 20 county maps**Bulletin No. 42. Mineral Production of California, by Counties, 1905, by	
**Bulletin No. 43. Mineral Production of California for Nineteen Years, by Charles G. Yale. Tabulated sheet	
**Bulletin No. 44. California Mines and Minerals for 1905, by Charles G.	
**Bulletin No. 45. Auriferous Black Sands of California, by J. A. Edman. 1907. 10 pp	
Bulletin No. 46. General Index of Publications of the California State Mining Bureau, by Charles G. Yale. 1907, 54 pp **Bulletin No. 47. Mineral Production of California, by Counties, 1906,	\$0.30
by Charles G. Yale. Tabulated sheet**Bulletin No. 48. Mineral Production of California for Twenty Years.	
1906, by Charles G. Yale  **Bulletin No. 49. Mines and Minerals of California for 1906, by Charles	
G. Yale. 34 pp.  Bulletin No. 50. The Copper Resources of California, 1908, by A. Haus-	
mann, J. Kruttschnitt, Jr., W. E. Thorne and J. A. Edman, 366 pp., 74 illustrations. (Revised edition.)	1.00
**Bulletin No. 51. Mineral Production of California, by Counties, 1907, by D. H. Walker. Tabulated sheet	
**Bulletin No. 52. Mineral Production of California for Twenty-one Years, 1907, by D. H. Walker. Tabulated sheet	
**Bulletin No. 53. Mineral Production of California for 1907, with County Maps, by D. H. Walker, 62 pp	
**Bulletin No. 54. Mineral Production of California, by Counties, by D. H. Walker, 1908. Tabulated sheet	
**Bulletin No. 55. Mineral Production of California for Twenty-two Years, by D. H. Walker, 1908. Tabulated sheet	
**Bulletin No. 56. Mineral Production for 1908, with County Maps and Mining Laws of California, by D. H. Walker. 78 pp	
**Bulletin No. 57. Gold Dredging in California, by W. B. Winston and	
Chas. Janin. 1910, 312 pp., 239 illustrations and 10 maps**Bulletin No. 58. Mineral Production of California, by Counties, by D. H.	
Walker, 1909. Tabulated sheet**Bulletin No. 59. Mineral Production of California for Twenty-three Years,	
by D. H. Walker, 1909. Tabulated sheet**Bulletin No. 60. Mineral Production for 1909, County Maps and Mining	
Laws of California, by D. H. Walker. 94 pp. **Bulletin No. 61. Mineral Production of California, by Counties for 1910,	
by D. H. Walker. Tabulated sheet*Bulletin No. 62. Mineral Production of California for Twenty-four Years,	
by D. H. Walker, 1910. Tabulated sheet**Bulletin No. 63. Petroleum in Southern California, by P. W. Prutzman.	
1912, 430 pp., 41 illustrations, 6 maps**Bulletin No. 64. Mineral Production for 1911, by E. S. Boalich. 49 pp	
**Bulletin No. 65. Mineral Production for 1912, by E. S. Boalich. 64 pp **Bulletin No. 66. Mining Laws of the United States and California. 1914,	
89 pp. **Bulletin No. 67. Minerals of California, by Arthur S. Eakle. 1914,	
226 pp**Bulletin No. 68. Mineral Production for 1913, with County Maps and	
Mining Laws, by E. S. Boalich. 160 pp**Bulletin No. 69. Petroleum Industry of California, with Folio of Maps	
(18 by 22), by R. P. McLaughlin and C. A. Waring. 1914, 519 pp., 13 illustrations, 83 figs. [18 plates in accompanying folio.]	
**Bulletin No. 70. Mineral Production for 1914, with County Maps and Mining Laws. 184 pp	
**Bulletin No. 71. Mineral Production for 1915, with County Maps and Mining Laws, by Walter W. Bradley. 193 pp., 4 illustrations	

#### BULLETINS—Continued.

	Asterisks (**) indicate the publication is out of print.
Pric	Bulletin No. 72. The Geologic Formations of California, by James Perrin
\$0.2	Smith. 1916, 47 pp. Reconnaissance Geologic Map (of which, Bulletin 72 is explanatory),
2.5	in 23 colors. Scale: 1 inch equals 12 miles. Mounted**Bulletin No. 73. First Annual Report of the State Oil and Gas Super-
	visor of California, for the fiscal year 1915-16, by R. P. McLaughlin.
	278 pp., 26 illustrations
12	Bulletin No. 74. Mineral Production of California in 1916, with County
Fre	Maps, by Walter W. Bradley. 179 pp., 12 illustrations**Bulletin No. 75. United States and California Mining Laws, 1917. 115 pp.,
	paperpaper
	Bulletin No. 76. Manganese and Chromium in California, by Walter W.
	Bradley, Emile Huguenin, C. A. Logan, W. B. Tucker and C. A.
.5	Waring, 1918. 248 pp., 51 illustrations, 5 maps, paper
	Bulletin No. 77. Catalogue of Publications of California State Mining
$\mathbf{Fr}$	Bureau, 1880-1917, by E. S. Boalich. 44 pp., paper
	Bulletin No. 78. Quicksilver Resources of California, with a Section on
	Metallurgy and Ore-Dressing, by Walter W. Bradley, 1918. 389 pp.,
1.5	77 photographs and 42 plates (colored and line cuts), cloth
4 (	Bulletin No. 79. Magnesite in California, by Walter W. Bradley, 1925.
1 (	140 pp., 62 photographs, 11 plates, cloth
	Bulletin No. 80. Tungsten, Molybdenum and Vanadium in California.
	Bulletin No. 81. Foothill Copper Belt of California. (In preparation.)
-	**Bulletin No. 82. Second Annual Report of the State Oil and Gas Super-
	visor, for the fiscal year 1916-1917, by R. P. McLaughlin, 1918. 412 pp.,
	31 illustrations, cloth
	Bulletin No. 83. California Mineral Production for 1917, with County
$\mathbf{Fr}$	Maps, by Walter W. Bradley. 179 pp., paper
	**Bulletin No. 84. Third Annual Report of the State Oil and Gas Saper-
	visor, for the fiscal year 1917-1918, by R. P. McLaughlin, 1918.
	617 pp., 28 illustrations, cloth
	**Bulletin No. 85. Platinum and Allied Metals in California, by C. A. Logan,
	1919. 10 photographs, 4 plates, 120 pp., paperBulletin No. 86. California Mineral Production for 1918, with County
Fre	Maps, by Walter W. Bradley, 1919. 212 pp., paper
1.1.	**Bulletin No. 87. Commercial Minerals of California, with notes on their
	uses, distribution, properties, ores, field tests, and preparation for
	market, by W. O. Castello, 1920. 124 pp., paper
	Bulletin No. 88. California Mineral Production for 1919, with County
$\mathbf{Fr}$	Maps, by Walter W. Bradley, 1920. 204 pp., paper
	**Bulletin No. 89. Petroleum Resources of California, with Special Reference
	to Unproved Areas, by Lawrence Vander Leck, 1921. 12 figures, 6
-	photographs, 6 maps in pocket, 186 pp., cloth
12	Bulletin No. 90. California Mineral Production for 1920, with County
Fre	Maps, by Walter W. Bradley, 1921, 218 pp., paper
1.0	Bulletin No. 91. Minerals of California, by Arthur S. Eakle, 1923, 328 pp.,
1.0	Bulletin No. 92. Gold Placers of California, by Chas. S. Haley, 1923. 167
	pp., 36 photographs and 7 plates (colored and line cuts, also geologic
1.5	map), cloth
	Extra copies of the Geologic Map (in 4 colors)
	Bulletin No. 93. California Mineral Production for 1922, by Walter W
Fre	Bradley, 1923, 188 pp., paper
	Bulletin No. 94. California Mineral Production for 1923, by Walter W.
Fre	Bradley, 1924, 162 pp., paper
0	Bulletin No. 95. Geology and Ore Deposits of the Randsburg Quadrangle,
2.0	by Carlton D. Hulin, 1925. 148 pp., 5 maps and numerous plates, cloth
Fre	Bulletin No. 96, California Mineral Production for 1924, by Walter W. Bradley, 1925. 173 pp., paper
T. L.	11. Drawey, 1020. 110 pp., paper

#### PRELIMINARY REPORTS.

Asterisks (**) indicate the publication is out of print.	Price
**Preliminary Report No. 1. Notes on Damage by Water in California Oil	
**Preliminary Report No. 2. Notes on Damage by Water in California Oil	
Fields, March, 1914. By R. P. McLaughlin. 4 pp	
Boalich. 32 pp	
Proliminary Report No. 4. Tungsten, Molybdenum and Vanadium. By E. S. Boalich and W. O. Castello, 1918. 34 pp. Paper	Free
Preliminary Report No. 5. Antimony, Graphite, Nickel, Potash, Strontium	r ree
and Tin. By E. S. Boalich and W. O. Castello, 1918. 44 pp. Paper **Preliminary Report No. 6. A Review of Mining in California During 1919.	Free
Fletcher Hamilton, 1920. 43 pp. Paper	
**Preliminary Report No. 7. The Clay Industry in California. By E. S. Boalich, W. O. Castello, E. Huguenin, C. A. Logan, and W. B. Tucker,	
1920. 102 pp. 24 illustrations. Paper**Preliminary Report No. 8. A Review of Mining in Caifornia During	
1921, with Notes on the Outlook for 1922. Fletcher Hamilton, 1922.	
68 pp. Paper	
MISCELLANEOUS PUBLICATIONS.	
Asterisks (**) indicate the publication is out of print.  **First Annual Catalogue of the State Museum of California, being the collec-	
tion made by the State Mining Bureau during the year ending April 16,	
1881. 350 pp**Catalogue of books, maps, lithographs, photographs, etc., in the library of	,
the State Mining Bureau at San Francisco, May 15, 1884. 19 pp	
**Catalogue of the State Museum of California, Volume II, being the collection made by the State Mining Bureau from April 16, 1881, to May 5,	
1884. 220 pp**Catalogue of the State Museum of California, Volume III, being the collec-	
tion made by the State Mining Bureau from May 15, 1884, to March 31,	
1887. 195 pp**Catalogue of the State Museum of California, Volume IV, being the collec-	
tion made by the State Mining Bureau from March 30, 1887, to August	
20, 1890. 261 pp**Catalogue of the Library of the California State Mining Bureau, September	
1, 1892. 149 pp**Catalogue of West North American and Many Foreign Shells with Their	
Geographical Ranges, by J. G. Cooper. Printed for the State Mining	
Bureau, April, 1894**Report of the Board of Trustees for the four years ending September, 1900.	
15 pp. Paper	
Bulletin. Reconnaissance of the Colorado Desert Mining District. By Stephen Bowers, 1901. 19 pp. 2 illustrations. Paper	Free
Commercial Mineral Notes. A monthly mimeographed sheet, beginning April, 1923	Free
	Fiee
MAPS.  Registers of Mines With Maps.	
Asterisks (**) indicate out of print.	·
**Register of Mines, with Map, Amador County	Sec 410 411 49
**Register of Mines, with Map, Butte County **Register of Mines, with Map, Calaveras County	
**Register of Mines, with Map, El Dorado County	
**Register of Mines, with Map, Inyo County  **Register of Mines, with Map, Kern County	
**Register of Mines, with Map, Lake County **Register of Mines, with Map, Mariposa County	
**Register of Mines, with Map, Nevada County	00 00 mm mm
**Register of Mines, with Map, Placer County  **Register of Mines, with Map, Plumas County	
**Register of Mines, with Map, San Bernardino County	

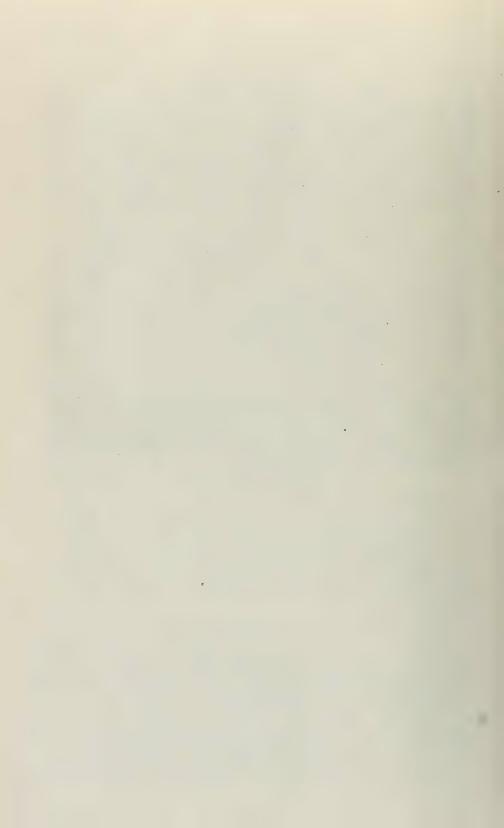
#### MAPS—Continued.

Asterisks (**) indicate the publication is out of print.	
**Register of Mines, with Map, San Diego County	Price
Register of Mines, with Map. Santa Barbara County	\$0.25
**Register of Mines, with Map, Shasta County	
**Register of Mines, with Map, Sierra County  **Register of Mines, with Map, Siskiyou County	
**Register of Mines with Man Trinity County	
**Register of Mines, with Map, Tuolumne County	
**Register of Mines, with Map, Tuolumne County Register of Mines, with Map, Yuba County	
Register of Oil Wells, with Map, Los Angeles City	
OTHER MAPS.	
Asterisks (**) indicate the publication is out of print.	
**Map of California, Showing Mineral Deposits (50 x 60 in.)—	
Map of Forest Reserves in California—	27.0
Mounted ***Immounted	.30
**Unmounted**Mineral and Relief Map of California	
**Map of El Dorado County, Showing Boundaries, National Forests	
**Map of Madera County, Showing Boundaries, National Forests	
**Map of Placer County, Showing Boundaries, National Forests*  **Map of Shasta County, Showing Boundaries, National Forests	
**Map of Shasta County, Showing Boundaries, National Forests*	
**Map of Siskiyou County, Showing Boundaries, National Forests	
**Map of Tuolumne County, Showing Boundaries, National Forests	
**Map of Mother Lode Region	
**Map of Desert Region of Southern CaliforniaMap of Minaret District, Madera County	.20
Map of Copper Deposits in California	.05
**Map of Calaveras County	
**Map of Plumas County*Map of Trinity County	.25
**Map of Tuolumne County	
Geological Map of Inyo County. Scale 1 inch equals 4 miles	.60
Map of California accompanying Bulletin No. 89, showing generalized classification of land with regard to oil possibilities. Map only, without Bulletin	.25
Geological Map of California, 1916. Scale 1 inch equals 12 miles. As	.20
accurate and up-to-date as available data will permit as regards topog-	
raphy and geography. Shows railroads, highways, post offices and other	
towns. First geological map that has been available since 1892, and shows geology of entire state as no other map does. Geological details	
lithographed in 23 colors. Mounted	2.50
Topographic Map of Sierra Nevada Gold Belt, showing distribution of	
auriferous gravels. In 4 colors	.50
OIL FIELD MAPS.	
These maps are revised from time to time as development work	
advances and ownerships change.	
Map No. 1—Sargent, Santa Clara CountyMap No. 2—Santa Maria, including Cat Canyon and Los Alamos	.50 .75
Map No. 3—Santa Maria, including Casmalia and Lompoc.	.75
Map No. 4—Whittier-Fullerton, including Olinda, Brea Canyon, Puente	
Hills, East Coyote and Richfield	.75
Map No. 5—Whittier-Fullerton, including Whittier, West Coyote, and Montebello	.75
Map No. 6—Salt Lake, Los Angeles County	.75
Map No. 7—Sunset and San Emido and Kern County	.75
Map No. 8—South Midway and Buena Vista Hills, Kern County Map No. 9—North Midway and McKittrick, Kern County	.75 .75
Map No. 10—Belridge and McKittrick, Kern County	.75

	OIL FIELD MAPS—Continued.	Price
Мар	No. 11-Lost Hills and North Belridge, Kern County	.78
Map	No. 12—Devils Den, Kern County	.73
Map	No. 13-Kern River, Kern County	\$0.7
Map	No. 14—Coalinga, Fresno County	1.0
	No. 15-Elk Hills, Kern County	.7
Map	No. 16—Ventura-Ojai, Ventura County	.73
Map	No. 17—Santa Paula-Sespe Oil Fields, Ventura County	.73
Map	No. 18—Piru-Simi-Newhall Oil Fields	.7.
Τ.	No. 19—Arroyo Grande, San Luis Obispo County	.73
	No. 20—Long Beach Oil Field	1.0
Map	No. 21—Portion of District 4, Showing Boundaries of Oil Fields, Kern	_
	and Kings counties	.7
Map	No. 22-Portion of District 3, Showing Oil Fields, Santa Barbara	
	County	.7
Map	No. 23—Portion of District 2, Showing Boundaries of Oil Fields,	_
	Ventura County	.7
Мар	No. 24—Portion of District 1, Showing Boundaries of Oil Fields, Los	_
	Angeles and Orange counties	.7
	No. 26—Huntington Beach Oil Field	.7
	No. 27—Santa Fe Springs Oil Field	.7
	No. 28—Torrance, Los Angeles County	.7
Map	No. 29—Dominguez, Los Angeles County	
	No. 30—Rosecrans, Los Angeles County	1.0
Map	No. 31—Inglewood, Los Angeles County	.7

#### DETERMINATION OF MINERAL SAMPLES.

Samples (limited to three at one time) of any mineral found in the state may be sent to the Bureau for identification, and the same will be classified free of charge. No samples will be determined if received from points outside the state. It must be understood that no assays, or quantitative determinations will be made. Samples should be in lump form if possible, and marked plainly with name of sender on outside of package, etc. No samples will be received unless delivery charges are prepaid. A letter should accompany sample, giving locality where mineral was found and the nature of the information desired.



		age
A. B. C. Gem Mine		
Abe Lincoln Placer Mine		462
Abel, W. Cook Placer Mine		462
Acachuma MineAdjudicated mining terms and phrases		542
Adjudicated mining terms and phrases	77-	-121
Administration Division122	258 397	573
Mails and files122	258 397	573
Mans and message 122	, 200, 001,	579
New publications 122	, 200, 091,	579
Personnel 122		
Advance Mine		
Ager Coal Mine		425
Agricultural lime:		
in San Diego County		372
in Ventura County		240
in Ventura County		563
Aldrich and Hegler Mine		453
Alice and Modoc Mine		002
Alisal Ranch Deposit	42	2, 30
Alta California Mine		287
Alviso and Sunshine Claims		507
Amblygonite (see Lithia).		
American Asbestos and Manufacturing Company		164
Asbestos Products Company		
Encaustic Tiling Company	358	375
Gold Dredging Company	169	101
Gold Dredging Company	102,	974
Lithia and Chemical Company		3/4
Pottery Company		354
Pottery Company		16
Ames Copper Prospect.		427
Prospect		431
Analysis:		
of amphibolite schist from Calaveras County		169
of clay from El Cajon Kaolin Deposit		354
of clay from Loofburrow Deposit		302
of clay from Looiburtow Deposit	202	204
of coal from Humboldt County of dolomite from Aumaier and Roderjuez deposit	000,	504
of dolomite from Aumaier and Roderjuez deposit		513
of granite from McKoon Silver-gray Granite Quarry		301
of iron ore from McKinney Iron Mines		
of limestone from Humboldt County		318
of limestone from Tassajero Group		522
of limestone from Ventura County	239	240
of minoral water from springs of Santa Barbara County	554	-556
of mineral water from springs of Šanta Barbara County of natural cement rock from Ventura County		240
of natural cement rock from ventura County		250
of ore from Friday Mine		332
of quartz from Hammond Property		217
of salts from Soda Lake		536
of salts from Soda Lake of silver-gray granite from Eucalyptus Ranch Quarry		365
of Ventura Velvet Molding sand		241
of volcanic ash from Weatherby Ranch		324
of water from Buckman Springs		
of water from El Granito Mineral Springs		381
of water from Merry Hill Mineral well		595
of water from Nuvida Mineral Spring		
of water from Warner's Hot Spring		382
ancient channels of the Duncan Canyon Region:		
Placer County	275	-280
map of		276
mines	276	-280
topography and geology		276
Anderson Placer		462
Anderson & Hardison Pressed Brick Company		237
Angels Character Clares et al. Character Clares Company		168
Angels Greenstone Company		108
Marble Quarry		168
Antimony:		
in Merced County		175
in San Luis Obispo County		504
Antone Sandstone Quarry		497
Apex Mine		144
Mining Company		144

	Page
Arastra Flat Group of Claims	. 229
Argilla Group of Claims. Arington and Putman Gravel Pit.	. 239
Arington and Putman Gravel Pit	196
Arroyo La Cruz deposit.	510
in Monterey County	28
in Monterey County	. 329
Asbestos, 1924 production	259
in Calaveras County	. 163
in Calaveras County in Merced County in Monterey County	. 175
in Monterey Countyin San Luis Obispo County	. 28 504
in Sak Dais Obispo County	420
in Siskiyou CountyProducing Company of California	164
Asphaltum:	
in Monterey County	_ 28
in Monterey Countyin Santa Barbara County	. 545
in Ventura County Associated Development Company	$\frac{232}{10}$
Associated Development Company Atlas Rook Company	217
Atlas Rock Company Aumaier and Roderjuez Dolomite deposit	513
Aurora Hydraulic Mine	292
Bachman Mine	
Bailey Mine	431
Baker MineBald Mountain Mine	- 451 976
Baldwin Group	431
Ball Mine	
Ball & Goforth Prospect	. 431
Ballena Placer	
Ballingal Placer	
Banes Soda Springs	
Bank MineBarite:	. ၁ət
in Calaveras County	164
in Humboldt County	. 300
in Merced County	. 175
in Monterey County	. 28
in Santa Barbara County	. 545 204
in Stanislaus County	$\frac{204}{204}$
Bark House Creek Placer	464
Bark House Creek Placer	427
Quartz Mine	. 431
Barona Mine	. 330
Barton Claims	427
Barytes (see Barite).	. 146
Bay Development Company	. 55
Poor Crook Placer Mine	5/11
Den Claim Beaudry Placer Mine Becket, J. F., bituminous rock deposit_ Bedell, L. E., copper claims Beeman silica deposit_ Bella Lecophina Mine	457
Beaudry Placer Mine  Baglet I E bituminous reals denotit	- 404 505
Bedell I. E. conner claims	. 31
Beeman silica deposit	375
Dene Josephine Wille	_ 101
Bellota Gravel Pit	. 196
Bence Mine	145
Bender Mine	. 431
Bender Mine Bennett Company Bent Bros., Inc., Gravel Pit Benton Ranch quicksilver deposit	189
Benton Ranch quicksilver deposit	530
SHICA GEDOSI	. 010
Berg, George, copper prospect	179
Bernardo Granite Quarries	300
Beryllium in San Diego County	254
Bibliography of molding sands of Sacramento County	$\frac{234}{22}$
of Siskiyou County	
of Siskiyou County Big Bar and Big Bar Annex Mine	. 308
Bend Mine	. 464
Four Group of Claims	229

	Page
Big Ledge Mine.	431
Nugget Placer Mine	462
Slide Mine	460
Trees Iron Deposit	162
Bishop's Peak Quarry	537
Bishop's Peak Quarry Bismuth in San Diego ('ounty Bitterwater Spring	33(
Bitterwater Spring	524
Bituminous rock, 1924 production.	258
in San Luis Obispo County	504
in Santa Barbara County	026
in Ventura County	202
Black Bear Quartz Mine	431
Diamond Gold Onartz Mine	290
Diamond Gold Quartz Mine	432
Mine	534
Lead Mine	465
Mountain Arsenic Company	329
Mine	329
Black sand:	
in Del Norte County	284
in Humboldt County	300
in Santa Barbara County	541
Wonder Mine	170
Blay, M. V., cited	165
Blind Lode Mine	439
Bloomer Mine	465
Blue Bell Group of Claims	229
Gravel Mine	465
Hill Mine	465
Jay Mine	433
(See also Manchester.)	
Jeans prospect	438
Ledge Mine	427
Light Mine	63
Silver Mines Company	465
Nose MineBluejay Mine	145
Bonaly Mine	485
Bonanza group	433
iron deposit	162
iron deposit	433
Bondo Mine	309
Bonneyville Quartz Mine	308
Borates, 1924 production	260
Borax in Ventura County233-	-236
Borden silica deposit	3/0
Borrego Springs	433
Boston Consolidated Mine	145
Mine	145
Boulder Creek Consolidated Gold Mining and Milling Company	334
Mines	334
mining district	331
Placer Mine	
Point Mine	466
prospect	434
Bour molybdenum deposit	351
Bowers, Stephen, cited59 Bowersox Mine	466
Boyle Mine 434,	453
Bradley Spring	381
Walter W	
W. W., cited212,	495
& Welch Placer	489
Brazil Mine	466
Brea Canyon Mine	
Brewery Mine	38
Briceland Estate gas well	320
in Humboldt County	301
in Merced County.	
	355

m San Joaquin County	Page
, Q T : Ol: Q .	. 188
Brick—Continued:  in San Joaquin County in San Luis Obispo County in Ventura County and tile, 1924 production of Briggs Mine Brooklyn Mine Brown Bear Mine Eagle group group of claims	. 505
in ventura County	. 237
Reigres Mine	. 9/8
Brooklyn Mino	101
Brown Rear Mine	131
Fagle group	41
group of claims	334
& George Mine	
Buckeye Flat Mining Company.	15
Manganese Mine	212
Buckman Springs	381
Buclimo Mining Company	_ 39
Budan Springs	526
Buena Vista Mine	533
Building stone in San Luis Obispo County	. 537
Bullion, Dealers in, must take out licenses.	)–396
Hill Mine (see Washington Mine).	
Burns Placer Mine	
property	_ 22
Ranch, asbestos on	421
William, Flacer (see Joubert Placer Mines).	_ 28
Burro Asbestos Mine	375
Burroughs Silica Mine	434
Mound Sulphur Springs	553
Bush, R. D	563
Bushnell Mine	39
Butler, E. L., Ranch	15
Buzzard Hill Mine	434
. Inc	446
Mine	428
Bythenia Springs	553
Cady, C. C., Asbestos prospect	421
Caen Quarry	537
Calaveras Cement Company Copper Company	. 165
Copper Company	143
County13	
1 17 11 7 4 1 71 1	0-1/2
bibliography of publications on	. 141
bibliography of publications on geography of	141
bibliography of publications on geography of geology of	141 135 140
geography of publications on geology of mineral resources of	135 140 136
geography of publications on geology of mineral resources of table of mineral production	135 140 136
bibliography of publications on geography of geology of mineral resources of table of mineral production iron deposit (see Big Trees deposit).	135 140 136 139
bibliography of publications on geography of	135 140 136 139 150
bibliography of publications on geography of	135 140 136 139 150
bibliography of publications on geography of geology of mineral resources of table of mineral production iron deposit (see Big Trees deposit). Mine Calcite in Merced County California-American Marble Company	135 140 136 139 150 177
bibliography of publications on geography of geology of. mineral resources of table of mineral production iron deposit (see Big Trees deposit). Mine Calcite in Merced County. California-American Marble Company Asbestos Company Clay Products Company 35	135 140 136 139 150 177 168 164 1, 355
bibliography of publications on geography of geology of mineral resources of table of mineral production iron deposit (see Big Trees deposit).  Mine Calcite in Merced County California-American Marble Company Asbestos Company Clay Products Company 35 Foundries, Directory of 56	141 135 140 136 139 150 177 168 164 1, 355 8–572
bibliography of publications on geography of geology of mineral resources of table of mineral production iron deposit (see Big Trees deposit).  Mine-Calcite in Merced County California-American Marble Company Asbestos Company Clay Products Company 55 Foundries, Directory of 56 Foundry sands 25	- 141 - 135 - 140 - 136 - 139 - 177 - 168 - 164 4, 355 8-572 1-257
bibliography of publications on geography of geology of mineral resources of table of mineral production iron deposit (see Big Trees deposit).  Mine-Calcite in Merced County-California-American Marble Company-Asbestos Company-Clay Products Company-Soundaries, Directory of 56 Foundries, Directory of 56 Foundry sands-Soundaries, 25 bibliography on 55	- 141 - 135 - 140 - 136 - 139 - 150 - 177 - 168 - 164 4, 355 8-572 1-257 4-255
Bibliography of publications on geography of geology of mineral resources of table of mineral production iron deposit (see Big Trees deposit).   Mine	- 141 - 135 - 140 - 136 - 139 - 150 - 177 - 168 - 164 - 164 - 1, 355 8-572 1-257 4-255 - 252
bibliography of publications on geography of geology of mineral resources of table of mineral production iron deposit (see Big Trees deposit).  Mine	- 141 - 135 - 140 - 136 - 139 - 150 - 177 - 168 - 164 4, 355 8-572 1-257 4-255 - 252 - 253
bibliography of publications on geography of geology of mineral resources of table of mineral production iron deposit (see Big Trees deposit).  Mine-Calcite in Merced County-California-American Marble Company-Asbestos Company-Clay Products Company-Special Company-Clay Products Company-Special Company-	- 141 - 135 - 140 - 136 - 139 - 150 - 177 - 168 - 164 4, 355 8-572 1-257 4-255 - 252 - 252 - 252 - 252
bibliography of publications on geography of geology of mineral resources of table of mineral production iron deposit (see Big Trees deposit).  Mine-Calcite in Merced County-California-American Marble Company-Asbestos Company-Clay Products Company-Special Company-Clay Products Company-Special Company-	- 141 - 135 - 140 - 136 - 139 - 150 - 177 - 168 - 164 4, 355 8-572 1-257 4-255 - 252 - 252 - 252 - 252
bibliography of publications on geography of geology of mineral resources of table of mineral production iron deposit (see Big Trees deposit).  Mine Calcite in Merced County California-American Marble Company Asbestos Company Clay Products Company 35 Foundries, Directory of 56 Foundry sands 25 bibliography on 25 core sand fire sand molding gravels molding sand	- 141 - 135 - 140 - 136 - 139 - 150 - 177 - 168 - 164 4, 355 8-572 1-257 4-255 - 252 - 253 - 252 - 252 - 253
bibliography of publications on geography of geology of mineral resources of table of mineral production iron deposit (see Big Trees deposit).  Mine-Calcite in Merced County California-American Marble Company Asbestos Company Clay Products Company Spoundries, Directory of 56 Foundry sands 25 bibliography on 25 core sand fire sand molding gravels molding sand parting sand steel sand	- 141 - 135 - 140 - 136 - 139 - 150 - 177 - 168 - 164 1, 355 8-572 1-257 - 252 - 253 - 252 - 253 - 253 - 253 - 253 - 253 - 253
bibliography of publications on geography of geology of mineral resources of table of mineral production iron deposit (see Big Trees deposit).  Mine-Calcite in Merced County California-American Marble Company Asbestos Company Clay Products Company Spoundries, Directory of 56 Foundry sands 25 bibliography on 25 core sand fire sand molding gravels molding sand parting sand steel sand	- 141 - 135 - 140 - 136 - 139 - 150 - 177 - 168 - 164 1, 355 8-572 1-257 - 252 - 253 - 252 - 253 - 253 - 253 - 253 - 253 - 253
bibliography of publications on geography of geology of mineral resources of table of mineral production iron deposit (see Big Trees deposit).  Mine	- 141 - 135 - 140 - 136 - 139 - 177 - 168 - 164 4, 355 - 252 - 252 - 252 - 252 - 253 - 252 - 253 - 253
bibliography of publications on geography of geology of mineral resources of table of mineral production iron deposit (see Big Trees deposit).  Mine	- 141 - 135 - 140 - 136 - 139 - 177 - 168 - 164 4, 355 - 252 - 252 - 252 - 252 - 253 - 252 - 253 - 253
bibliography of publications on geography of geology of mineral resources of table of mineral production iron deposit (see Big Trees deposit).  Mine	- 141 - 135 - 140 - 136 - 139 - 177 - 168 - 164 4, 355 - 252 - 252 - 252 - 252 - 253 - 252 - 253 - 253
bibliography of publications on geography of geology of mineral resources of table of mineral production iron deposit (see Big Trees deposit).  Mine Calcite in Merced County California-American Marble Company Asbestos Company Clay Products Company 35- Foundries, Directory of 56 Foundry sands 25 bibliography on 25 core sand fire sand molding gravels molding sand steel sand tests of, Table Kieselguhr Company, Inc. Magnesite Company Ocher Mining Company	- 141 - 135 - 140 - 136 - 139 - 164 4, 355 8-572 1-257 - 252 - 252 - 253 - 253 - 253 - 253 - 253 - 253 - 253 - 253 - 252 - 253 - 252 - 253 - 252 - 253 - 252 - 253 - 253
bibliography of geology of geology of mineral resources of table of mineral production iron deposit (see Big Trees deposit).  Mine Calcite in Merced County California-American Marble Company Asbestos Company Clay Products Company 35- Foundries, Directory of 56 Foundry sands 25 bibliography on 25 core sand fire sand molding gravels molding gravels molding sand parting sand steel sand tests of, Table Kieselguhr Company, Inc. Magnesite Company Ocher Mining Company Pottery Company, The 17	- 141 - 135 - 140 - 136 - 139 - 157 - 168 - 164 4, 355 8-572 1-257 4-255 - 252 - 253 - 253 - 253 - 253 - 253 - 208 - 32 - 301 - 5, 179
bibliography of geology of geology of mineral resources of table of mineral production iron deposit (see Big Trees deposit).  Mine Calcite in Merced County California-American Marble Company Asbestos Company Clay Products Company 35- Foundries, Directory of 56 Foundry sands 25 bibliography on 25 core sand fire sand molding gravels molding gravels molding sand parting sand steel sand tests of, Table Kieselguhr Company, Inc. Magnesite Company Ocher Mining Company Pottery Company, The 17	- 141 - 135 - 140 - 136 - 139 - 157 - 168 - 164 4, 355 8-572 1-257 4-255 - 252 - 253 - 253 - 253 - 253 - 253 - 208 - 32 - 301 - 5, 179
bibliography of geology of geology of mineral resources of table of mineral production iron deposit (see Big Trees deposit).  Mine Calcite in Merced County California-American Marble Company Asbestos Company Clay Products Company 35- Foundries, Directory of 56 Foundry sands 25 bibliography on 25 core sand fire sand molding gravels molding gravels molding sand parting sand steel sand tests of, Table Kieselguhr Company, Inc. Magnesite Company Ocher Mining Company Pottery Company, The 17	- 141 - 135 - 140 - 136 - 139 - 157 - 168 - 164 4, 355 8-572 1-257 4-255 - 252 - 253 - 253 - 253 - 253 - 253 - 208 - 32 - 301 - 5, 179
bibliography of geology of geology of mineral resources of table of mineral production iron deposit (see Big Trees deposit).  Mine Calcite in Merced County California-American Marble Company Asbestos Company Clay Products Company 35- Foundries, Directory of 56 Foundry sands 25 bibliography on 25 core sand fire sand molding gravels molding gravels molding sand parting sand steel sand tests of, Table Kieselguhr Company, Inc. Magnesite Company Ocher Mining Company Pottery Company, The 17	- 141 - 135 - 140 - 136 - 139 - 157 - 168 - 164 4, 355 8-572 1-257 4-255 - 252 - 253 - 253 - 253 - 253 - 253 - 208 - 32 - 301 - 5, 179
bibliography of geology of geology of mineral resources of table of mineral production iron deposit (see Big Trees deposit).  Mine Calcite in Merced County California-American Marble Company Asbestos Company 35. Foundries, Directory of 56 Foundry sands 25 bibliography on 25 core sand fire sand molding gravels molding gravels molding sand steel sand tests of, Table Kieselguhr Company, Inc. Magnesite Company Ocher Mining Company Pottery Company, The Pottery Company (see also Valley Spring Clay Pit). Refining Company — Californite in Siskiyou County Calmo Mining and Milling Company Comp	135 - 140 - 136 - 137 - 140 - 136 - 139 - 150 - 177 - 168 - 164 - 152 - 252 - 253 - 252 - 253 - 252 - 253 - 252 - 253 - 255 - 32 - 255 - 32 - 255 - 32 - 255 - 32 - 255 - 32 - 255 - 35 - 3
bibliography of publications on geography of geology of mineral resources of table of mineral production iron deposit (see Big Trees deposit).  Mine Calcite in Merced County California-American Marble Company Asbestos Company Clay Products Company 35- Foundries, Directory of 56 Foundry sands 25 bibliography on 25 core sand fire sand molding gravels molding sand steel sand tests of, Table Kieselguhr Company, Inc. Magnesite Company Ocher Mining Company	135 - 140 - 136 - 137 - 140 - 136 - 139 - 150 - 177 - 168 - 164 - 152 - 252 - 253 - 252 - 253 - 252 - 253 - 252 - 253 - 255 - 32 - 255 - 32 - 255 - 32 - 255 - 32 - 255 - 32 - 255 - 35 - 3

	Pag	е
Campbell, Forest L.	12	6
M. R., cited	2	9
Placer Mine	46	6
Campo iron deposit	35	1
molybdenum depositCannon & Company molding sand		1
Pottery		2
Canon Bar Mine	. 30	
Del Diablo Mine	23	2
Cape Cod Mine	43	5
Capistrano limestone deposit		
Capitol Sand and Gravel Company		
Carmel Coal Mines		0
Development Company		
Carpenter & Robertson Mine	. 46	6
Carpinteria Clay Products Company	54	6
Carson Hill Gold Mines, Inc.	14	6
Mining Company	53	0
MineQuicksilver Mining Company	53	2
Casey & Bach claim	14	2
Cassadoga Mine	. 43	55
Castac Mine	. 23	5U
Mining Company	23	17
Castro MineCavanaugh Mine	30	10
Cavanaugh MineCecila Barrett placer property	. 30	5
Cecilville Placer Mine		
Celite Products Company	. 54	18
Cement, 1924 production	$_{-26}$	60
in Calaveras County	. 16	60
in Merced County	. 17	10
Centerville iron deposit	31	7
Central Mine435	. 45	58
Petroleum Company	_ ]	11
property	_ 43	35
Supply Company (see Templeton Sand Plant).	43	25
Champion MineChaparral Hill Group	_ 46	
Operating Company151, 154		
Chapman Mine		50
prospect	_ 43	
Chastain, Jason, limestone deposit	_ 49	92
Cherry Hill Mine	- 46	50 61
China Paul Mine	44	$\frac{1}{47}$
Cholame Grant		$\frac{1}{42}$
Chorro Creek Mine	_ 50	07
Christianson, Nels, Mine	_ 29	93
Chromite, 1924 production		60 e =
in Calaveras Countyin Del Norte County	- 11	95
in Humboldt County	30	01
in Monterey County		$\overline{29}$
in San Luis Obispo County	_ 50	07
in Santa Barbara County		45
in Siskiyou County		
in Stanislaus County Cinnabar (see Quicksilver).	_ 20	UĐ
Claim Holders Association (see Sanger Peak Copper).		
Classic Hill Mine	_ 40	66
Claus group (see Rinconada Mine).		
Clay:		0
in Calaveras County	- 10	67
in Del Norte County		$\frac{87}{02}$
in Humboldt Countyin Merced County	1'	
in Monterey County	4	29
in Orange County	64-6	
in San Diego County	_ 38	54
in San Joaquin County	_ 19	90

Clay—Continued.	Page
in San Luis Obispo County	
in San Bulls Obispo County	. 505
in Santa Barbara County	
in Stanislaus Countyin Stanislaus County	
in Ventura County	. 236
Industry of Sacramento County	. 2
pottery, 1924 production of	. 579
Clear Creek Mine	428
Cleaver Mine	436
Cleveland-Pacific Mine	
Clover Flat Placer Mine	
Coal, 1924 production of	
in Del Norte County	205
in Humboldt County30	
in Merced County	179
in Monterey County	29-31
in Orange County	
in San Joaquin County	_ 190
in San Luis Obispo County	510
in Siskiyou County42.	5 - 426
in Stanislaus County	
Coast Rock and Gravel Company	10
Cobalt in Calaveras County	2 026
Colemanite in Ventura County23	3-230
Colorado Chrome Mine	507
Columbia Mine	_ 437
Columbus Mine	$_{-}$ 234
Columbus Mine	. 383
Commodore Mine	_ 437
Comparison of mineral industry with agriculture	575
Concrete, Pumice aggregate in	405
Conrad, Geo. W., asbestos deposit.	491
Comadidate Discourse Del Comanidate	505
Consolidated Bituminous Rock Company	_ 505
Chemical Company	_ 555
Contact Mine	_ 230
& Bonanza claims	$_{-}$ 437
Continental Shale Products Company	_ 557
Conzetti Placer Mine	467
Cook, Abel W., Placer Mine	462
Mineral Spring	320
Cooley Ranch, Coal on	426
Cooley Railch, Coal oil	200
Copper, 1924 production	_ 090
Creek Mine	_ 280
in Calaveras County	_ 142
in Del Norte County	_ 287
in Humboldt County30	5 - 308
in Merced County	_ 179
in Monterey County	_ 31
in San Diego County	
in San Luis Obispo County	0-512
in Santa Barbara County	5/11
in Santa Barbara County	C 400
in Siskiyou County42	U-428
King Mine Mountain group (see Barnum Bros. Copper prospect).	_ 041
Mountain group (see Barnum Bros. Copper prospect).	400
Corey Brothers Mine	_ 438
prospect Costs, Mining, at Carson Hill Gold Mines, Inc.	_ 437
Costs, Mining, at Carson Hill Gold Mines, Inc.	$_{-}$ 150
Covas Grante Quarry	_ 004
Cowgill Quicksilver Mine	$_{-}495$
Coy, Owen C., cited28	1. 295
Crapo Placer Mine	467
Crary, S. R., Mine	487
Oracy, S. 16, White	120
Crawfish Gulch Mine	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
Crawley Mine	
Crimson Copper Group	_ 305
Crocker properties	$_{-}$ 192
Crossus Placer Mine	467
Cronin Placer Mine 46' Croton Bar Mine (see Bondo Mine).	7, 471
Croton Bar Mine (see Bondo Mine).	
Crushed rock (see also Stone, Miscellaneous), 1924.	
orusing for and Stolle, Amsternations), 1024.	5-587
production of58 Cub Bear and Blue Jeans prospects	120
Cub Dear and Dive Jeans prospects	_ 430
Cunningham & Son sand plant	
Cummignation & Source Pression and Pression	- 11
Cypress Chrome Mine	_ 507

	1	Pago
D. I. C Mirror		
Daley Copper MineSand and gravel plant		
Dave Savoy Placer Mine		291
Davis Consolidated Mines		467
Davis Consolidated Mines Estate, Reeves, Californite on Estate, Reeves, Reeves		493
Mine (see Clear Creek Mine)		
Day David T., cited		284
Hawk Mine  Dealers in gold-silver ores and bullion must take out licenses		291
Dealers in gold-silver ores and bullion must take out licenses.	.390-	-396
Deer Park limestone deposit		370
mining district		520
Trail Mine		358
Delaney group.		300
Del Norte County:		
goography		281
geology mineral resources		282
mineral resources	.282 -	-294
table of mineral production		409
Del Monte Properties Company		54
Demarest Mine		151
Denny Bar Company		225
Deterton iron deposit		169
Daway Mina		438
Dewey Mine		293
Diatomaceous earth:		
in Merced County		181
in Monterey County	3	2-36
in San Joaquin County		190
in San Luis Obispo County	.512-	-513
in Santa Barbara County	.547-	-552
in Siskiyou County		206
in Stanislaus County		238
Dick Morris Placer		469
Dietrich W F cited		505
Dietrich W F cited		505
Dietrich, W. F., cited	515-	505 428 -518
Dietrich, W. F., cited	515-	505 428 -518
Dietrich, W. F., cited	.515- .568- .413-	505 428 -518 -572 -562
Dietrich, W. F., cited.  Dillon Creek prospects.  Direct steel process of Wakama Iron and Steel Company.  Directory of California Foundries.  District Reports of Mining Engineers.  1-71, 135-245, 275-382,  Division of Minerals and Statistics.  123-125, 259-266, 398-402.	.515- .568- 413- .574-	505 428 -518 -572 -562 -587
Dietrich, W. F., cited	.515- .568- 413- 574- 574-	505 428 -518 -572 -562 -587 -587
Dietrich, W. F., cited	.515- .568- 413- 574- 574-	505 428 -518 -572 -562 -587 -587 123
Dietrich, W. F., cited	.515 .568 413 .574 .574	505 428 -518 -572 -562 -587 -587 123 -577
Dietrich, W. F., cited_ Dillon Creek prospects_ Direct steel process of Wakama Iron and Steel Company_ Directory of California Foundries_ District Reports of Mining Engineers1-71, 135-245, 275-382, Division of Minerals and Statistics	.515- .568- 413- 574- 574-	505 428 -518 -572 -562 -587 -587 123 -577 277 287
Dietrich, W. F., cited Dillon Creek prospects. Direct steel process of Wakama Iron and Steel Company. Directory of California Foundries District Reports of Mining Engineers. 1-71, 135-245, 275-382, Division of Minerals and Statistics. 123-125, 259-266, 398-402, 1924 production statistics. 259-265, 398-402, estimate of 1924 output. summary for 1924 Dixie Queen Mine Doctor Rock group Doggett Mine.	.515- .568- 413- 574- 574-	505 428 -518 -572 -562 -587 -587 123 -577 287 469
Dietrich, W. F., cited.  Dillon Creek prospects.  Direct steel process of Wakama Iron and Steel Company.  Directory of California Foundries.  District Reports of Mining Engineers. 1-71, 135-245, 275-382,  Division of Minerals and Statistics. 123-125, 259-266, 398-402,  1924 production statistics. 259-265, 398-402,  estimate of 1924 output.  summary for 1924.  Dixie Queen Mine.  Doctor Rock group.  Doggett Mine.  Dolan's Hot Springs.	.515- .568- 413- 574- 574-	505 $428$ $-518$ $-572$ $-562$ $-587$ $123$ $-577$ $277$ $287$ $469$
Dietrich, W. F., cited. Dillon Creek prospects. Direct steel process of Wakama Iron and Steel Company. Directory of California Foundries District Reports of Mining Engineers. 1-71, 135-245, 275-382, Division of Minerals and Statistics. 123-125, 259-266, 398-402, 1924 production statistics. 259-265, 398-402, estimate of 1924 output. summary for 1924 Dixie Queen Mine. Doctor Rock group Doggett Mine Dolan's Hot Springs Dolomite, 1924 production	.515- .568- 413- 574- 574-	505 $428$ $-518$ $-572$ $-562$ $-587$ $123$ $-577$ $287$ $469$ $45$
Dietrich, W. F., cited_ Dillon Creek prospects_ Direct steel process of Wakama Iron and Steel Company_ Directory of California Foundries_ District Reports of Mining Engineers1-71, 135-245, 275-382, Division of Minerals and Statistics123-125, 259-266, 398-402, 1924 production statistics259-265, 398-402, estimate of 1924 output	.515 .568 413 .574 .574	505 $428$ $-518$ $-572$ $-562$ $-587$ $123$ $-577$ $287$ $469$ $45$ $36$
Dietrich, W. F., cited. Dillon Creek prospects. Direct steel process of Wakama Iron and Steel Company. Directory of California Foundries District Reports of Mining Engineers 1-71, 135-245, 275-382, Division of Minerals and Statistics 123-125, 259-266, 398-402, 1924 production statistics 259-265, 398-402, estimate of 1924 output. summary for 1924 Dixie Queen Mine Doctor Rock group Doggett Mine Dolan's Hot Springs Dolomite, 1924 production in Monterey County in San Luis Obispo County.	.515- .568- 413- 574- 574-	505 $428$ $-518$ $-572$ $-562$ $-587$ $-587$ $287$ $287$ $469$ $45$ $36$ $513$
Dietrich, W. F., cited. Dillon Creek prospects. Direct steel process of Wakama Iron and Steel Company. Directory of California Foundries District Reports of Mining Engineers. 1-71, 135-245, 275-382, Division of Minerals and Statistics. 123-125, 259-266, 398-402, 1924 production statistics. 259-265, 398-402, estimate of 1924 output. summary for 1924 Dixie Queen Mine. Doctor Rock group Doggett Mine. Dolan's Hot Springs. Dolomite, 1924 production in Monterey County. in San Luis Obispo County. Dominion Mining Organization, Inc.	515- 568- 413- 574- 574-	505 428 -518 -572 -562 -587 -587 -587 277 287 469 45 -513 -513
Dietrich, W. F., cited_ Dillon Creek prospects_ Direct steel process of Wakama Iron and Steel Company_ Directory of California Foundries_ District Reports of Mining Engineers	515- 568- 413- 574- 574-	505 428 -518 -572 -562 -587 -587 -277 287 469 45 261 36 513 151 359
Dietrich, W. F., cited. Dillon Creek prospects. Direct steel process of Wakama Iron and Steel Company. Directory of California Foundries. District Reports of Mining Engineers. 1-71, 135-245, 275-382, Division of Minerals and Statistics. 123-125, 259-266, 398-402, 1924 production statistics. 259-265, 398-402, estimate of 1924 output. summary for 1924. Dixie Queen Mine. Doctor Rock group Doggett Mine. Dolan's Hot Springs. Dolomite, 1924 production in Monterey County in San Luis Obispo County. Dominion Mining Organization, Inc. Dos Cabezas feldspar deposits limestone deposit silica deposits.	515- 568- 413- 574- 574-	508428 $-518$ $-572$ $-562$ $-587$ $123$ $-577$ $277$ $287$ $469$ $45$ $513$ $151$ $359$ $370$ $375$
Dietrich, W. F., cited. Dillon Creek prospects. Direct steel process of Wakama Iron and Steel Company. Directory of California Foundries. District Reports of Mining Engineers. 1-71, 135-245, 275-382, Division of Minerals and Statistics. 123-125, 259-266, 398-402, 1924 production statistics. 259-265, 398-402, estimate of 1924 output. summary for 1924. Dixie Queen Mine. Doctor Rock group Doggett Mine. Dolan's Hot Springs. Dolomite, 1924 production in Monterey County in San Luis Obispo County. Dominion Mining Organization, Inc. Dos Cabezas feldspar deposits limestone deposit silica deposits.	515- 568- 413- 574- 574-	508428 $-518$ $-572$ $-562$ $-587$ $123$ $-577$ $277$ $287$ $469$ $45$ $513$ $151$ $359$ $370$ $375$
Dietrich, W. F., cited Dillon Creek prospects Direct steel process of Wakama Iron and Steel Company Directory of California Foundries District Reports of Mining Engineers 1-71, 135-245, 275-382, Division of Minerals and Statistics 259-266, 398-402, 1924 production statistics 259-265, 398-402, estimate of 1924 output summary for 1924 Dixie Queen Mine Doctor Rock group Doggett Mine Dolan's Hot Springs Dolomite, 1924 production in Monterey County in San Luis Obispo County. Dominion Mining Organization, Inc. Dos Cabezas feldspar deposits limestone deposit silica deposits Doty group Double Eagle and Little Quartz claims	515- 568- 413- 574- 574-	505 428 -518 -572 -562 -587 123 -577 277 261 36 36 513 1519 370 375 438
Dietrich, W. F., cited. Dillon Creek prospects. Direct steel process of Wakama Iron and Steel Company. Directory of California Foundries District Reports of Mining Engineers 1-71, 135-245, 275-382, Division of Minerals and Statistics 123-125, 259-266, 398-402, 1924 production statistics 259-265, 398-402, estimate of 1924 output. summary for 1924 Dixie Queen Mine Doctor Rock group. Doggett Mine Dolan's Hot Springs Dolomite, 1924 production in Monterey County in San Luis Obispo County. Dominion Mining Organization, Inc. Dos Cabezas feldspar deposits limestone deposit silica deposits Doty group Double Eagle and Little Quartz claims Douglas gem claim	515- 568- 413- 574- 574-	505 428 -518 -572 -562 -587 123 -577 277 261 36 36 513 1519 370 375 438
Dietrich, W. F., cited. Dillon Creek prospects. Direct steel process of Wakama Iron and Steel Company. Directory of California Foundries District Reports of Mining Engineers	515- 568- 413- 574- 574-	505 428 -518 -572 -562 -587 123 -577 277 277 261 369 370 375 531 438 362
Dietrich, W. F., cited Dillon Creek prospects Direct steel process of Wakama Iron and Steel Company Directory of California Foundries District Reports of Mining Engineers 1-71, 135-245, 275-382, Division of Minerals and Statistics 259-266, 398-402, 1924 production statistics 259-265, 398-402, estimate of 1924 output summary for 1924 Dixie Queen Mine Doctor Rock group Doggett Mine Dolan's Hot Springs Dolomite, 1924 production in Monterey County in San Luis Obispo County. Dominion Mining Organization, Inc. Dos Cabezas feldspar deposits limestone deposit silica deposits Doty group Double Eagle and Little Quartz claims Douglas gem claim Dredging, Gold in Calaveras County	515- 568- 413- 574- 574-	505 428 -518 -572 -562 -587 -587 -123 -277 287 469 45 370 375 438 362 162
Dietrich, W. F., cited. Dillon Creek prospects. Direct steel process of Wakama Iron and Steel Company. Directory of California Foundries District Reports of Mining Engineers 1-71, 135-245, 275-382, Division of Minerals and Statistics 123-125, 259-266, 398-402, 1924 production statistics 259-265, 398-402, estimate of 1924 output. summary for 1924 Dixie Queen Mine Doctor Rock group Doggett Mine Dolan's Hot Springs Dolomite, 1924 production in Monterey County in San Luis Obispo County. Dominion Mining Organization, Inc. Dos Cabezas feldspar deposits limestone deposit silica deposits. Doty group Double Eagle and Little Quartz claims Douglas gem claim Dredging, Gold in Calaveras County in Sacramento County	515- 568- 413- 574- 574-	505 428 -518 -572 -587 123 -587 123 -577 287 469 48 261 375 375 375 375 531 438 362 162
Dietrich, W. F., cited Dillon Creek prospects Direct steel process of Wakama Iron and Steel Company Directory of California Foundries District Reports of Mining Engineers District Reports of Mining Engineers District Reports of Mining Engineers 1-71, 135-245, 275-382, Division of Minerals and Statistics 259-266, 398-402, estimate of 1924 output summary for 1924  Dixie Queen Mine Doctor Rock group Doggett Mine Dolan's Hot Springs Dolomite, 1924 production in Monterey County in San Luis Obispo County. Dominion Mining Organization, Inc. Dos Cabezas feldspar deposits limestone deposit silica deposits Doty group Double Eagle and Little Quartz claims Douglas gem claim Dredging, Gold in Calaveras County in Sacramento County in Siskiyou County Drift mines in Sacramento County	515- 568- 413- 574- 574- 574- 	505 428 428 -518 -572 -587 -587 -587 -277 287 469 370 513 151 359 370 531 438 362 -491 15
Dietrich, W. F., cited Dillon Creek prospects Direct steel process of Wakama Iron and Steel Company Directory of California Foundries District Reports of Mining Engineers District Reports of Mining Engineers District Reports of Mining Engineers 1-71, 135-245, 275-382, Division of Minerals and Statistics 259-266, 398-402, estimate of 1924 output summary for 1924  Dixie Queen Mine Doctor Rock group Doggett Mine Dolan's Hot Springs Dolomite, 1924 production in Monterey County in San Luis Obispo County. Dominion Mining Organization, Inc. Dos Cabezas feldspar deposits limestone deposit silica deposits Doty group Double Eagle and Little Quartz claims Douglas gem claim Dredging, Gold in Calaveras County in Sacramento County in Siskiyou County Drift mines in Sacramento County	515- 568- 413- 574- 574- 574- 	505 428 428 -518 -572 -587 -587 -587 -277 287 469 370 513 151 359 370 531 438 362 -491 15
Dietrich, W. F., cited. Dillon Creek prospects. Direct steel process of Wakama Iron and Steel Company. Directory of California Foundries District Reports of Mining Engineers 1-71, 135-245, 275-382, Division of Minerals and Statistics 259-266, 398-402, 1924 production statistics 259-265, 398-402, estimate of 1924 output. summary for 1924 Dixie Queen Mine Doctor Rock group Doggett Mine Dolan's Hot Springs. Dolomite, 1924 production in Monterey County in San Luis Obispo County. Dominion Mining Organization, Inc. Dos Cabezas feldspar deposits limestone deposit silica deposits. Doty group Double Eagle and Little Quartz claims Douglas gem claim. Dredging, Gold in Calaveras County in Sacramento County in Sacramento County Drift mines in Sacramento County Drift mines in Sacramento County Dry Young Hydraulic Mine Duncan Canyon Region, Placer County, Ancient channels of	515-568-413-574-574-574-574-574-574-574-574-574-574	505 $428$ $-518$ $-518$ $-587$ $-562$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-687$ $-6$
Dietrich, W. F., cited Dillon Creek prospects Direct steel process of Wakama Iron and Steel Company Directory of California Foundries District Reports of Mining Engineers 1-71, 135-245, 275-382, Division of Minerals and Statistics 259-266, 398-402, 1924 production statistics 259-265, 398-402, estimate of 1924 output summary for 1924  Dixie Queen Mine Doctor Rock group Doggett Mine Dolan's Hot Springs Dolomite, 1924 production in Monterey County in San Luis Obispo County. Dominion Mining Organization, Inc. Dos Cabezas feldspar deposits limestone deposit silica deposits Doty group Double Eagle and Little Quartz claims Douglas gem claim Dredging, Gold in Calaveras County in Sacramento County Dr. Young Hydraulic Mine Dunnizan Placer	515-568-413-574-574-574-574-574-574-574-574-574-574	505 $428$ $-518$ $-518$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-5$
Dietrich, W. F., cited. Dillon Creek prospects. Direct steel process of Wakama Iron and Steel Company. Directory of California Foundries District Reports of Mining Engineers 1-71, 135-245, 275-382, Division of Minerals and Statistics 259-266, 398-402, 1924 production statistics 259-265, 398-402, estimate of 1924 output. summary for 1924  Dixie Queen Mine Doctor Rock group. Doggett Mine Dolan's Hot Springs Dolomite, 1924 production in Monterey County in San Luis Obispo County. Dominion Mining Organization, Inc. Dos Cabezas feldspar deposits limestone deposit silica deposits Doty group Double Eagle and Little Quartz claims Douglas gem claim Dredging, Gold in Calaveras County in Sacramento County in Siskiyou County Drift mines in Sacramento County Dr. Young Hydraulic Mine Duncan Canyon Region, Placer County, Ancient channels of Dunnigan Placer Dutro Mine	515-568-413-574-574-574-574-574-574-574-574-574-574	505 428 -518 -572 -572 -587 -123 -577 287 469 45 363 513 151 359 370 371 438 362 -491 152 -292 -2469 459 500 500 500 500 500 500 500 500 500 5
Dietrich, W. F., cited Dillon Creek prospects Direct steel process of Wakama Iron and Steel Company Directory of California Foundries District Reports of Mining Engineers 1-71, 135-245, 275-382, Division of Minerals and Statistics 259-266, 398-402, 1924 production statistics 259-265, 398-402, estimate of 1924 output summary for 1924  Dixie Queen Mine Doctor Rock group Doggett Mine Dolan's Hot Springs Dolomite, 1924 production in Monterey County in San Luis Obispo County. Dominion Mining Organization, Inc. Dos Cabezas feldspar deposits limestone deposit silica deposits Doty group Double Eagle and Little Quartz claims Douglas gem claim Dredging, Gold in Calaveras County in Sacramento County Dr. Young Hydraulic Mine Dunnizan Placer	515-568-413-574-574-574-574-574-574-574-574-574-574	505 $428$ $-518$ $-518$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-587$ $-5$
Dietrich, W. F., cited Dillon Creek prospects Direct steel process of Wakama Iron and Steel Company Directory of California Foundries District Reports of Mining Engineers	515-568-413-574-574-574-574-574-574-574-574-574-574	505428 $-505428$ $-572$ $-587$ $-587$ $-587$ $-277$ $287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-287$ $-28$
Dietrich, W. F., cited Dillon Creek prospects Direct steel process of Wakama Iron and Steel Company Directory of California Foundries District Reports of Mining Engineers	515-568-413-574-574-574-574-574-574-574-574-574-574	505 428 -518 -572 -572 -587 -123 -577 287 469 45 363 513 151 359 370 371 438 362 -491 152 -292 -2469 459 500 500 500 500 500 500 500 500 500 5
Dietrich, W. F., cited. Dillon Creek prospects. Direct steel process of Wakama Iron and Steel Company. Directory of California Foundries District Reports of Mining Engineers 1-71, 135-245, 275-382, Division of Minerals and Statistics 259-266, 398-402, 1924 production statistics 259-265, 398-402, estimate of 1924 output. summary for 1924  Dixie Queen Mine Doctor Rock group. Doggett Mine Dolan's Hot Springs Dolomite, 1924 production in Monterey County in San Luis Obispo County. Dominion Mining Organization, Inc. Dos Cabezas feldspar deposits limestone deposit silica deposits Doty group Double Eagle and Little Quartz claims Douglas gem claim Dredging, Gold in Calaveras County in Sacramento County in Siskiyou County Drift mines in Sacramento County Dr. Young Hydraulic Mine Duncan Canyon Region, Placer County, Ancient channels of Dunnigan Placer Dutro Mine	515-568-413-574-574-574-574-574-574-574-574-574-574	505 $428$ $-572$ $-562$ $-587$ $-123$ $-577$ $277$ $2469$ $45$ $375$ $438$ $362$ $162$ $-292$ $-280$ $468$ $168$ $168$

	Page
East Fork group	_ 293
Easter MineEastlick Mine	_ 438
Easyz Bird Mine	152
Easyz Bird Mine Ebony Black Granite Quarry (see Stockdale Granite Quarry). Echstine Clay deposit	
Eclipse and Old Vet group	_ 29
Ed Fletcher Jr. Mine	362
Edmundson & Sanford claim	485
Elman & Boorse prospect	428
El Bonito Springs Bottling Company El Cajon Kaolin deposit	_ 381
El Divisadero Chrome Mine	507
El Encino Gravel Mine	161
El Granito Mineral Springs	381
Eliza Mine Elizabeth and Winona group	_ 439
Elk and Landslide claims	336
Elkhorn Hydraulic Mine	292
Mine	_ 309
Elliott Creek district, Siskiyou County	_ 420
Placer Mine Ellis Mine (see Descanso Mine).	_ 469
El Oro No. 3 Dredge	_ 490
El Salto Chrome Mine	507
Elsemore, W. C., rock-crushing plant	_ 321
El Toro deposit Empire Mine	_ 152
Employment service133, 274, 41	1. 595
positions wanted133, 274, 41	1, 595
Encinitas Copper Mine	_ 331
CompanyEngelhart Paving and Construction Company	_ 331
Enterprise group	439
Erickson Quarry	562
Escondido Mine (see Cleveland-Pacific Mine).	
Esmeralda Extension and Tellurium claims (see Bence Mine).  property, Lepidolite in	373
Esperanza Mine	
(see also Boston Mine).	
Ester group	_ 336
Eucalyptus Ranch Quarry_ Eureka Brick and Tile Company (see Thompson Brick Company).	_ 364
and W J. D. prospects.	439
Evans manganese deposit	<b>523</b>
Ranch chrome deposit	
Evening Star Mine43 Evergreen Placer	
Everton Pocket Mine	_ 450
Ewing, Ed, Diatomaceous earth prospect	_ 429
Expansion group	_ 336
Extraction of shale oil	_ 997
Fagundez Mine43	9, 445
Fairbanks, H. W., cited59, 67, 33	
Fairchild prospect	_ 439
Falcon prospect	549
Feldspar:	- 010
1924 production of	
in Monterey County	$\frac{36}{358}$
in San Diego County Felts Mineral Spring	320
Fenn, R. G., gravel plant	379
Fenton-Parker Materials Company	
Chollas Valley plant	
Murray Canyon plant	
Sand plant	_ 379
Spring Valley plant	_ 379
Ferrell deposit	- 512
Fighting Bob No. 1 claimFinnegan Mine	
Fiock Bros. Quarry	
riock Dios. Quarry	

	Page
Fippen & Hayden Mine	466
lead ore in	491
Firebug prospect (see Eureka and W. J. D. prospects).	
Fir Tree Placer Mine	470
Fish group	153
Flag prospect	439
Fleetwood and Nannie S. Mine	
Fletcher Jr., Ed., Mine	362
Florence Placer Mine	310
Foley Mine	230
Folsom Granite Quarry	
Ford Mine (see Apex Mine).	
Forest Creek Mining Company	153
Forks of Salmon River Mining Company	485
Forks Placer Mine	470
Fortner Ranch manganese	. 163
Fossiliferous limestone in Ventura County	. 240
Foundries, California, Directory of	-572
Foundry sands, California 251	-257
Frances group	336
Francis Cleaner Mine. Frank, John, Mine (see Gold Bank Mine). Peters Gas Well.	. 537
Frank, John, Mine (see Gold Bank Mine).	
Peters Gas Well	. 320
Zarr Copper Mine	. 288
Franklin Mine	. 440
Franks & Moncton Mine	440
Frazer Mine	. 231
Frazier Mine	235
Placer Mine	471
Free Coinage Mine	336
Fremont Peak, Barite on	. 28
French Hill Chrome Mine	. 286
Mine	292
Fresno County, Oil field development72, 246, 383	. 563
Friday Copper Mining Company 330	. 352
Mine330	. 352
prospect	286
Froom, Mrs., Ranch deposit	507
Fuels in Sacramento County	. 10
natural gas	11
petroleum	10
petroleum	261
in San Diego County	360
Gabbro, Orbicular, in San Diego County	369
Galena Mine	440
Gallia Placer Mine	471
Garber Brick and Tile Company Garden Grove Sand and Gravel Company	65
Garden Grove Sand and Gravel Company	71
Garnet in Monterey County	37
Garretson Springs	493
Gas (see Natural Gas).	
wells in San Joaquin County	. 195
Gates, Frank A., gravel plant	562
Gearheart Placer Geeshan & Kellner Placer Mine	472
Geeshan & Kellner Placer Mine	473
Gem materials:	
in Del Norte County	. 290
in Humboldt County	. 308
in San Diego County329	, 361
in Siskiyou County	493
Gems, 1924 production of	261
General Petroleum Company	. 360
George Cook Placer Mine	292
Mine	531
Washington Placer claims	292
and Brown Mine	466
Gettysburg Silver Mining Company	321
Gibson Bar Drift Mine	473
Gilfeather group	440
Gilta Quartz Mine	440
Gilta Quartz Mine	191
Glenn Consolidated Mine	-278
Gloria Copper claimGoddard-McKay Mines Company (see Chapman Mine).	511
Goddard-McKay Mines Company (see Chapman Mine).	

	Page
Gold, 1924 production of	
Bank & John Frank Mines	_ 489
Bank Placer Mine	473
Crown group discovery in 1841 in Ventura County	_ 33 ( 220
dredging in Siskiyou County490	7-491
Hill Mine	
Placer Mine	_ 473
in Calaveras County14	4 - 162
in Del Norte County	
in Humboldt County30	
in Monterey County	$\frac{101}{37-49}$
in Orange County	59 - 62
in Sacramento County	11 - 16
in San Diego County33	1 - 349
in San Joaquin County	
in San Luis Obispo County	
in Santa Barbara Countyin Siskiyou County43	-241
in Stanislaus County	206
in Ventura County22	9 - 232
Knoll Mining Company	_ 153
Leaf Placer	_ 473
Run Minesilver ores, Dealers in, must take out licenses39	$\frac{441}{0.206}$
Standard and North Star Mines	J-390 337
Golden and Eveleth Mine	
Bloom group of claims	
Chariot Mine	_ 337
Mining Corporation	_ 337
Eagle claim	441
Mine308 Nugget Mine (see Elliott Placer Mine).	5, 440
Rod Mine	310
Rule and Scott Bar claims	474
Seal claim	_ 441
West prospect	_ 441
Goldman, M., clay land	_ 179
Goodman prospect Goodwill Copper Mine (see Los Osos Mine).	441
Goodwill Copper Mine (see Los Osos Mine).	
Gorda Mine	_ 09
Gould Mine	_ 533
Gragg, Hazzard, deposit	- 512
Grand Central Sulphur Spring	_ 324
Granite: 1924 production of	- 580
in San Diego County36	3 – 368
in Siskiyou County	_ 491
Mountain Mine	_ 339
Rock Company (see Templeton sand plant).	
Graphite: in Humboldt County	317
in San Diego County	_ 369
Great Northern Quicksilver Mine, Inc.	_ 495
Green Mountain Mine	_ 170
Extension claim	$_{-}$ 171
Mine	- 101
Greening, Scott, Claims, californite on	428
Grider Mine	474
Griffin Onyx Marble Quarry	493
Grinding-mill pebbles (see Stone, miscellaneous).	,
Grizzly Gulch Mine	_ 441
Grove & Sons gravel plant	_ 379
Guadalupe copper claimGuerra deposit	551
Guerra depositGuerro copper claim	511
Gumboot prospect	441
Gypsum Canyon deposit	_ 67
1924 production of	_ 201
in Orange County	_ 67

Gypsum Canyon Deposit—Continued·		age
in San Joaquin County		191
in San Luis Obispo County in Santa Barbara County		
in Stanislaus County		
in Ventura County		
Haley, Chas. S., cited		202
Hammer Placer Mine		
Hammond claims	31	, 40
Hammond's silica property		
Hansen, John, gravel plant		
Hard Climb prospect		
Harder, E. C., cited	520,	521
Hard Luck Mine		
Hardy Mine		154
Hardy Mine		351
Hatton Ranch deposit		53
Haw manganese claimQuarry		319
Hawkins chrome deposit		
Gold Mining Company		154
group		154
Hayden & Fippin Mine		400
Hazzard Gragg deposit		512
Hearst Ranch, manganese on Heaton, R. C., Mineral water well		523
Heaton, R. C., Mineral water well		525
Hegler Mine& Aldrich Mine		
Heins Lake clay deposit.		29
Helms Soda Springs		45
Hematite: in Del Norte County		503
in Humboldt County		
in San Joaquin County		191
in Stanislaus County		
Hercules group of claims		
Hickey Mine		
Hicks Mine		443
Hidden Treasure claim————————————————————————————————————		432
High-grading Act	390-	-396
High Peak Mine		339
Plateau group		286
Highland Mine prospect		443
Hill, J. M., cited	9. 40	). 41
Himalaya property, Lepidolite in		373
Hittell, T. H., cited		229
Hobson, W. K., copper claims		511
Hogan Quarry Hollister Estate Company (see Salsipuedes Ranch deposit; also Las Cruces Hot Sp		562
Hollister Estate Company (see Salsipuedes Ranch deposit; also Las Cruces Hot Sp Holmes Ranch mineral paint	rings	s). 169
Homestake Consolidated Mines, Inc.		
Mine		444
Hood, George, crushed rock plant		294
Hoosier Hill Placer Hopkins, F. C., Placer Mining Company		333
Horner, R. R., cited		284
Horse Mountain Copper Company	301.	306
district Hot Springs on North Fork of Little Sur River	.305	-308 4.5
Houts, W. A., clay deposit		167
Howard, Henry claims, Californite on		493
Mine (see Plaskett).		FO-
Huer-Huero Springs		$\frac{525}{320}$
County:		020
geography		$\frac{295}{295}$
geology		

	Page
list of coal occurrences in	303
mineral resources296 table of mineral production	208
Humpback Quartz Mine	445
Hunt, A. N., Quarry	. 323
Hunters Luck claims	. 288
Iaqua Medicinal Spring	200
Ida May Quartz Mine	
Imperial Heights Mine	474
Mining Company	. 339
Incello Company, The	
Indian Creek Gold Mining Company	155
Mine (see Golden Eagle Mine).	
Industrial minerals, in Calaveras County 166 International Gold Mines Company 166	3-172
Inyo Mine	447
Ireys black granite deposit	365
Iron:	
in Calaveras County	. 162
in Del Norte Countyin Humboldt County	$\frac{298}{317}$
in San Diego County	_ 349
in San Joaquin County	_ 191
in San Luis Obispo County	
in Siskiyou County Master group of claims	350
Ironsides Mine	447
Iridium (see platinum metals).	
Isaac Minor Quarry Isabel Dredge	169
Isabella Copper Mine	429
Isham's Spring (see Nuvida Mineral Spring).	
Jackson Mine (see Fleetwood and Nannie S. Mine).  Jacoby Creek quarry	323
Laguament Hydraulia Mina (soo Callia Placer Mina)	
Jacumba Hot Springs	382
manganese group	350
Jason Chastain limestone deposit	- 492 360
Jens Quarry	
Jillson Mine	_ 442
Joe Ramus Placer	469
John Frank and Gold Bank Mines507	1, 528
Johnson Bros. feldspar deposit	37
Johnson, H., asbestos claims	$_{-}$ 421
chromite	_ 424
& China Paul Mine	
Jolon district, Monterey County	_ 41
Jones & Klingers gravel plant	_ 380
Jose copper claim	179
Josephine group Mine	
Joubert Placer Mines	474
Judson Ranch molybdenum deposit	_ 351
Junbo Mine	_ 331
	. 447
Kaiser Paving Company's quarry	498
Kane Graphite Mine	
Karl Mine	
Katie May Mine	
Kaufman, E. E., cited	. 575
Kaus Placer Mine Kavanaugh, Barney, diggings (see Park & Brown Mine).	_ 292
Kayanaugh, Barney, diggings (see Park & Brown Mine). Kay, C. B., ornamental sandstone deposit	. 493
Kearsarge & Pilot Knob claims	456
Kearsarge & Pilot Knob claims Keiselguhr Company of America (see Celite Products Company).	
Kellner & Goeshan Placer Mine	473

I	Page
Kellogg Ranch deposit	43
Kentuck S Mine Kern Construction Company, A. D. 294,	340
County, Oil field development in	563
Kessler onyx marble deposit	527
Springs	525
Keynote group	
Keystone Mine King Solomon Mine	
Kings County, Oil field development in	384
Kinkaid prospect	448
Kiser Ranch, magnesite on	
Kismet group	
Klamath group  Hot Springs	
River district	
Mine	
Klau Mine	531
Klondike group (see Schofield Copper Mine). Kunz, G. F., cited	171
Kunz, G. F., etted	1/1
La Bolsa Tile Company	65
Laboratory124, 266, 403,	588
Ladd Canyon deposit	68
Mine	207
Laguna mining district	331
Ranch deposits542,	546
Mine	541
La Habra Sand and Gravel Company	71
Laidet soapstone property	171
Lakeside feldspar deposit	359
lime and marl deposit	
silica deposit	375
Lakeview group of claims	350
La Laguna Ranch chrome deposit  La Libertad Mine	546
Lamphear Mine	155
Landslide claim (see Elk and Landslide claims).	100
Landslide claim (see Elk and Landslide claims).  Lanky Bob Mine	449
La Perin copper group	305
Lapis sand plant La Primea Chrome Mine	507
Las Amias Calientes (see Warner's Hot Springs)	
La Salle Canyon deposit	551
Las Cruces Hot Springs	554
Last Chance Mine161, Late Ocher Mine162,	341
Ranch sandstone	
La Trinidad Chrome Mine	
Lead, 1924 production of	399
in Orange County	2-64
in San Diego County	491
in Siskiyou County	101
Lee Quarry	537
Lehman Mine	530
Liberty Bond group	429
Manganese Mine	213
Library 126-131, 267-272, 404-409, 589-	-593
Official publications received	589
Licenses required by dealers in gold-silver ores and bullion390-	-396
Lime, 1924 production of Limestone:	580
1924 production of	580
in Calaveras County	
in Humboldt County	318
in Monterey County	
in Orange Countyin San Diego County	68 369
in San Diego Countyin San Joaquin County	
in San Luis Obispo County	522

	Page
in Santa Barbara County	
in Siskiyou County in Ventura County	39-240
Lindauer & Sons sand plant	71
Lind, J. C., limestone deposit	
List of coal occurrences in Humboldt County	303
Lithia, 1924 production of	262
in San Diego County	373
Little Bonanza Mine Bonsa Mine	
Gem and Snowflake Quartz claims	
Klondike Mine	308
Quartz claimsQueen (see Morrison & Carlock Mine).	438
Three Gem Mine	362
Livingston & Everton Pocket Mine	450
Lode Mines (see Gold).	
Logan, C. A	
London Chrome Mine	
Lone Pine Mining and Milling Company	346
Long Tom Placer group	476
Lookout group	302
Loney Canyon group	522
Los Angeles County, Oil field development in	84, 564
Field Division58-71, 223-245, 325-382, 5	539-562
Pressed Brick Company	
Los Burros district, Monterey County.	37
geology of	37
mines of	
Los Olivos deposit Los Osos Copper Mine	511
Los Prietos Mines Los Vergeles Ranch deposit	543
Los Vorgalos Ranch danosit	42
Los vergeles italien deposit	<del>1</del> 0
Lowden Placer4	76, 477
Lowden Placer4	76, 477
Lowden Placer4 Low Divide Mine (see Copper Creek Mine). Lower Siskiyou Mine	76, 477 450 480
Lowden Placer	450 480 481
Lowden Placer	76, 477 450 480 341 477
Lowden Placer	76, 477 450 480 341 477 508
Lowden Placer	76, 477 450 480 341 477 508 450
Lowden Placer	76, 477 450 480 341 477 508 450 341
Lowden Placer	76, 477 450 480 341 477 508 450 450 341 533
Lowden Placer	
Lowden Placer	
Lowden Placer	76, 477  450 480 341
Lowden Placer	76, 477 450 480 341 450 341 450 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341 341
Lowden Placer	76, 477  450 480 341 477 508 341 533 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262 262
Lowden Placer	76, 477  450 480 341 477 508 450 341 533 08, 592 262 319 181 43 523 608 210 262
Lowden Placer	76, 477
Lowden Placer	76, 477  450 480 341 508 450 341 533 262 319 43 523 262 317 533 553 353
Lowden Placer	76, 477
Lowden Placer	76, 477  450 480 341 477 508 450 341 533 08, 592 262 319 181 43 208 210 262 317 533 58, 397
Lowden Placer	76, 477
Lowden Placer	76, 477  450  480  481  477  508  450  341  533  08, 592  262  319  262  317  533  58, 397  492  450  450  581  181  181  181  183  591  181
Lowden Placer	76, 477  450  480  481  477  508  450  341  533  08, 592  262  319  319  317  533  58, 397  492  450  450  450  450  581  163  319  181  350  91  91  91
Lowden Placer	76, 477

	Page
Manilla manganese property	
Mann & Ross Drift Mine	477
Maple Creek coal deposit	
Maplesden Mine	
of Duncan Canyon Region, Placer County.	
of Horse Mountain copper properties306	308
Marble:	, , , , ,
in Calaveras County	
in Monterey County	
in San Diego County	. 369
in Siskiyou County , onyx, in Siskiyou County	492
Marden feldspar deposit	
silica deposit	376
silica deposit	341
Mariposa Mine	_ 40
Markeson Mine (see Bondo Mine).	109
Marks gravel pit	. 185
in San Diego County	372
in Ventura County	240
Marquat Estate, antimony deposit	
Marshall Mine	
Mary Alma claims	
Mason Valley Mine Company (see Grey Eagle Mine).	- 411
Matilija group of claims	240
McCann Placer	
McClaughry group	450
McCook Placer	479
McGary Mine (see Chapman Mine). McGilvray Raymond Granite Company	265
McKeen Mine 450	453
McKenzie Mine	
McKinney Iron Mines 518	8-521
McKoon Silver-gray Granite Quarry	_ 367
McNeals Bar Mine	
Meadows Gulch deposit	- 57
Melba group	342
Melones Mine	147
Melrose group	342
Melville property (see M. M. Mine).	
Merced County173	3-183
geography and geology of mineral resources of	173
oil field developments in	
table of mineral production	
Merced River Gravel Company	_ 183
Mercer Fraser Company gravel pits	_ 323
Mercury (see Quicksilver). Merry Hill mineral well	505
Metals Exploration Company (see Oceanic Mine).	_ 020
Metals:	
in Calaveras County	2-163
in Del Norte County28	4 - 294
in Humboldt County30	0-324
in Merced County	
in Monterey Countyin Orange County	
in Sacramento County	_2-22
in San Diego County32	9-353
in San Joaquin County18	8-200
in San Luis Obispo County49	9-538
in Santa Barbara County	
in Siskiyou County	
in Ventura County22	
Mexican Smelting and Refining Company (see Blue Ledge Mine).	202
Mica:	
in San Diego County	_ 374
in Ventura County	- 241
nuna, in ban Diego County	- 5/3

	Page
Michigan-Salmon Hydraulic Mine	
Middlemast chrome deposit	
Midwinter & Modoc claims	
Might, Wm., claims Milburn-McAvoy group	543
Miller, E. F., quicksilver claims	302
Miller gravel pit	197
Miller gravel pit	424
Mineral industry:	
compared to agriculture	
per cent of total freight tonnage due to	
in Calaveras County	
in San Diego County	374
in Stanislaus County	
in Ventura County	241
production: by countiesby	577
by substances	
estimate of 1924 output	123
estimate of 1924 output	-587
tables:	
Calaveras County	
Del Norte County Humboldt County	
Merced County	174
Monterey County	
Orange County	
Sacramento County	4
San Diego County	328
San Joaquin County	186
San Luis Obispo CountySanta Barbara County	541
Siskiyou County	422
Stanislaus County	202
Ventura County	226
Products Company	210
resources: of Calayeras County135	179
of Del Norte County281	-294
of Humboldt County295	-324
of Merced County173	-183
of Monterey County2	3-57
of Orange County5	8-71
of Sacramento County	1-22
of San Joaquin County184	-200
of San Luis Obispo County499	-538
of Santa Barbara County539	-562
of Siskiyou County414	-498
of Stanislaus County201	-222
of Ventura County228	-240
springs: in Humboldt County	320
in Monterey County4	4-50
in San Diego County380	1–382
in San Luis Obispo County	-526
in Santa Barbara County553	-556 402
in Siskiyou County water:	490
1924 production of	581
in Calayeras County	
in Humboldt County	320
in Monterey County4	4-50
in San Diego County380 in San Luis Obispo County524	528 528
in San Luis Obispo County553	-556 -556
in Siskiyon County	493
in Siskiyou County	-562
Law 77 terms and phrases, adjudicated 77	-121
terms and phrases, adjudicated77	-121 400
Minnehaha prospect	393
Minor, Isaac, Quarry Miscellaneous stone in Sacramento County	16

	Page
Mission Canyon deposit	
China Company	
Mitchell, R. P., sand plant	71
M. M. MineModoc Mine	40
and Midwinter claims	
Mok-Hill Mineral Springs	
Molding sand:	
1924 production of	
in Sacramento Countyin Ventura County	
Molybdenite:	2 I I
in Calaveras County	
in Monterey County	
in San Diego Countyin Ventura County	$\frac{350}{232}$
Monarch iron deposit (see Detert deposit).	
Quartz Mine	450
Moneton Mine	440
Monkey Creek Placer Mine	
Montecito Barytes deposit————————————————————————————————————	
Monte Cristo group	
Monterey Bay Salt Company	
Coal Company	
County:	23
geography	
geology mineral production, table of	$\frac{24}{26}$
mineral resources of	5-57
mineral well	. 44
Mission Tile Company	. 57
Products Company Montezuma Mine	
Montmorillonite in Santa Barbara County	
(see also Fuller's Earth).	0.20
Monumental Consolidated Quartz Mine	
Moore feldspar deposit	
Quarry Spring	555
Thomas W., limestone deposit	553
Moraga Ranch deposit	. 553
More Ranch deposit	551
Morgan Brothers Mine	
Morganza Drift Mine	
Morning Star Placer Mining Company	. 514
Morrell Placer Mine	. 292
Morris clay deposit	
, Dick, Placer Morrison & Carlock Mine	
Morro Rock Quarry	537
Morrow group of mines	. 64
Morton clay deposit	$\frac{355}{150}$
Mosher & Lowell claim  Mountain Chrome Mine	450
King group155	452
Laurel Quartz Mine	. 451
Lily Mine	. 363
Quartz Mine	. 451
View Springs Mount Vernon Consolidated Mine	459
Mowhawk Mine	
Muddox Pottery	. 10
Multum in Parvo Placer Mine	. 480
Municipal Baths Springs	. 525
Murray, J. J., asbestos claims	523
Museum124, 266, 402	, 588
Mutual Chrome Mine	. 508
Myers Pit (see Miller gravel pit).	
Mykrantz feldspar deposits	$\frac{359}{202}$

Nannie S Mine		age
	4	139
Nannie S Mine Napa County, Oil field development in Napoleon Copper Mine National Brick Company Cement Company Native Copper Company Son Placer Mine	75.9	287
Napaleon Copper Mine	149 1	61
Napoleon Copper Mine	142-1	104
National Brick Company		350
Cement Company		121
Native Copper Company		31
Son Placer Mine  Natomas Company of California  Natural cement rock in Ventura County	4	180
Natomas Company of California	3,	13
Natural cement rock in Ventura County	5	240
gas;		
1924 production of		521
in Humboldt County		990
in Humboldt County		20
in Orange County		08
in Sacramento County		11
in San Joaquin County	193-1	195
in Santa Barbara County		561
in Ventura County		242
Navajo Mines		514
Neilon & Putnam prospect.	. 4	152
Nels Christianson Mine		
Nelson Cooper Company gravel plant		280
and Cloon graved plant		270
and Sloan gravel plant		19
Nevins magnesite deposit		
New county reports		1
New Era Mine		180
Publications		
York Mine	40, 4	152
-Calayeras Mine (see Sherman Ranch Mine).		
Newsom's Springs		525
Newspapers on file, List of13		
Neys Springs	1, 2, 1, 100, 6	103
Nielal in Montaney County		50
Nickel, in Monterey County		
in San Diego County	,	302
Nigger Boy Mine		152
Hill Placer Mine		480
Noble Mines	:	343
Nigger Boy Mine Hill Placer Mine Noble Mines Noce Mine Nolan Gulch Placer		161
Nolan Gulch Placer	4	481
Nonmetals in Calaveras County	163-	172
in Del Norte County	284-9	294
in Del Norte County	284-2	294 394
Nolan Gulch Placer. Nonmetals, in Calaveras County in Del Norte County in Humboldt County	284-2	$\frac{294}{324}$
In Merced County	110-	TOO
in Monterey County	28-	-57
in Merced County in Monterey County in Orange County	28- 64-	-57 -71
in Merced County in Monterey County in Orange County	28- 64-	-57 -71
in Merced County in Monterey County in Orange County in Sacramento County in San Diego County	28- 	-57 -71 -22 382
in Montered County in Monterey County in Orange County in Sacramento County in San Diego County in San Joaquin County	28- 	-57 -71 -22 382
in Montered County in Monterey County in Orange County in Sacramento County in San Diego County in San Joaquin County	28- 	-57 -71 -22 382
in Montered County in Monterey County in Orange County in Sacramento County in San Diego County in San Joaquin County in San Luis Obispo County	28- 	-57 -71 -22 382 200 538
in Montered County in Monterey County in Orange County in Sacramento County in San Diego County in San Joaquin County in San Luis Obispo County in San tal Barbara County	28- 	-57 -71 -22 382 200 538
in Montered County in Monterey County in Orange County in Sacramento County in San Diego County in San Joaquin County in San Joaquin County in San Luis Obispo County in Santa Barbara County in Sishiyou County	28 64 28 353 188 499 545 414	-57 -71 -22 382 200 538 562
in Montered County in Monterey County in Orange County in Sacramento County in San Diego County in San Joaquin County in San Luis Obispo County in Santa Barbara County in Siskiyou County in Stanislaus County	28 64 2- 353- 188- 499- 545- 414- 204-	$   \begin{array}{r}     -57 \\     -71 \\     -22 \\     382 \\     200 \\     538 \\     562 \\     498 \\     222 \\   \end{array} $
in Montered County in Monterey County in Orange County in Sacramento County in San Diego County in San Joaquin County in San Luis Obispo County in Santa Barbara County in Siskiyou County in Stanislaus County in Stanislaus County in Ventura County	28 64 - 2 353 - 188 499 - 545 - 414 - 204 - 232	$ \begin{array}{r} -57 \\ -57 \\ -22 \\ 382 \\ 200 \\ 538 \\ 562 \\ 498 \\ 222 \\ 245 \\ \end{array} $
in Montered County in Monterey County in Orange County in Sacramento County in San Diego County in San Joaquin County in San Joaquin County in San Luis Obispo County in Santa Barbara County in Sishiyou County in Stanislaus County in Stanislaus County Norcross Chrome Mine	28 64 2 353- 188- 499- 545- 414- 204- 232-	$   \begin{array}{c}     -57 \\     -71 \\     -22 \\     382 \\     200 \\     538 \\     562 \\     498 \\     222 \\     245 \\     508 \\   \end{array} $
in Montered County in Monterey County in Orange County in Sacramento County in San Diego County in San Joaquin County in San Luis Obispo County in Santa Barbara County in Siskiyou County in Stanislaus County in Stanislaus County Norcross Chrome Mine Nordheimer Placer Mine	28- 64 22- 353- 188- 499- 545- 414- 204- 232-	$ \begin{array}{c} -57 \\ -71 \\ -22 \\ 382 \\ 200 \\ 538 \\ 562 \\ 498 \\ 224 \\ 508 \\ 481 \end{array} $
in Montered County in Monterey County in Orange County in Sarramento County in San Diego County in San Joaquin County in San Luis Obispo County in Santa Barbara County in Siskiyou County in Siskiyou County in Stanislaus County in Ventura County Norcross Chrome Mine North Central Region, Siskiyou County	28- 64 22- 353- 188- 499- 545- 414- 204- 232-	$ \begin{array}{c} -57 \\ -71 \\ -22 \\ 382 \\ 200 \\ 538 \\ 562 \\ 498 \\ 224 \\ 508 \\ 481 \end{array} $
in Montered County in Monterey County in Orange County in Sacramento County in San Diego County in San Joaquin County in San Luis Obispo County in Santa Barbara County in Sishiyou County in Stanislaus County in Stanislaus County in Ventura County Norcross Chrome Mine Nordheimer Placer Mine North Central Region, Siskiyou County Hubbard Mine (see Ready Relief).	28- 64- 22- 353- 188- 499- 545- 414- 204- 232-	-57 -71 -22 -3382 -2200 5538 5562 4498 5508 4416
in Montered County in Monterey County in Orange County in Sacramento County in San Diego County in San Joaquin County in San Luis Obispo County in Santa Barbara County in Siskiyou County in Siskiyou County in Stanislaus County in Ventura County Norcross Chrome Mine North Central Region, Siskiyou County Hubbard Mine (see Ready Relief). Star Mine	28- 64 22- 353- 188- 499- 545- 414- 232- 337, 453, 4	-57 -71 -22 382200 5538 5562 498 5222 45 508
in Montered County in Monterey County in Orange County in Sacramento County in San Diego County in San Joaquin County in San Luis Obispo County in Santa Barbara County in Santa Barbara County in Siskiyou County in Stanislaus County in Stanislaus County in Ventura County Norcross Chrome Mine North Central Region, Siskiyou County Hubbard Mine (see Ready Relief) Star Mine Northern California Dredge Company	28-64 -64-2-2 -353-188- -499- -545-414- -204- -232-	-57 -71 -22 382 200 538 556 222 24 550 8 481 533
in Montered County in Monterey County in Orange County in Sacramento County in San Diego County in San Joaquin County in San Luis Obispo County in Santa Barbara County in Santa Barbara County in Siskiyou County in Stanislaus County in Stanislaus County in Ventura County Norcross Chrome Mine North Central Region, Siskiyou County Hubbard Mine (see Ready Relief) Star Mine Northern California Dredge Company	28-64 -64-2-2 -353-188- -499- -545-414- -204- -232-	-57 -71 -22 382 200 538 556 222 24 550 8 481 533
in Montered County in Monterey County in Orange County in Sacramento County in San Diego County in San Joaquin County in San Luis Obispo County in San Luis Obispo County in Santa Barbara County in Siskiyou County in Stanislaus County in Stanislaus County in Ventura County Norcross Chrome Mine North Central Region, Siskiyou County Hubbard Mine (see Ready Relief). Star Mine Northern California Dredge Company N. T. U. Company, The	28- 64- 22- 353- 188- 499- 545- 414- 204- 232-	-57 -71 -22 382 200 538 556 222 24 550 8 481 533
in Montered County in Monterey County in Orange County in Sacramento County in San Diego County in San Joaquin County in San Luis Obispo County in Santa Barbara County in Santa Barbara County in Siskiyou County in Stanislaus County in Stanislaus County in Ventura County Norcross Chrome Mine North Central Region, Siskiyou County Hubbard Mine (see Ready Relief) Star Mine Northern California Dredge Company	28- 64- 22- 353- 188- 499- 545- 414- 204- 232-	-57 -71 -22 382 200 538 556 22 22 45 508 448 1416 533
in Montered County in Monterey County in Orange County in Sacramento County in San Diego County in San Joaquin County in San Luis Obispo County in Sant Barbara County in Santa Barbara County in Siskiyou County in Stanislaus County in Stanislaus County in Ventura County Norcross Chrome Mine North Central Region, Siskiyou County Hubbard Mine (see Ready Relief). Star Mine Northern California Dredge Company N. T. U. Company, The Nuvida Mineral Spring	28-64 22-353-188-499-545-414-232-337, 453,	-57 -71 -22 382 2200 538 556 222 45 508 441 653 3490 5559 382
in Montered County in Monterey County in Orange County in Sacramento County in San Diego County in San Joaquin County in San Luis Obispo County in Santa Barbara County in Sishiyou County in Stanislaus County in Stanislaus County in Ventura County Norcross Chrome Mine North Central Region, Siskiyou County Hubbard Mine (see Ready Relief). Star Mine Northern California Dredge Company N. T. U. Company, The Nuvida Mineral Spring	28- 64- 22- 353- 188- 499- 545- 414- 204- 232-	-57 -71 -22 238 2200 538 538 222 498 222 45 508 441 65 53 34 490 491
in Montered County in Monterey County in Orange County in Sacramento County in San Diego County in San Joaquin County in San Joaquin County in San Luis Obispo County in Santa Barbara County in Siskiyou County in Stanislaus County in Stanislaus County in Ventura County Norcross Chrome Mine Nordheimer Placer Mine North Central Region, Siskiyou County Hubbard Mine (see Ready Relief) Star Mine Northern California Dredge Company N. T. U. Company, The Nuvida Mineral Spring  Oak Bar Dredge Bottom Placer Syndicate	28-64 22-353-188-499-545-414-224-232-337, 453,	-57 -71 -22 -33 -53 -53 -53 -53 -53 -53 -53 -53 -53
in Montered County in Monterey County in Orange County in Sarramento County in San Diego County in San Joaquin County in San Joaquin County in San Luis Obispo County in Santa Barbara County in Siskiyou County in Stanislaus County in Stanislaus County in Ventura County Norcross Chrome Mine Northeimer Placer Mine North Central Region, Siskiyou County Hubbard Mine (see Ready Relief) Star Mine Northern California Dredge Company N. T. U. Company, The Nuvida Mineral Spring  Oak Bar Dredge Bottom Placer Syndicate Flat and East Fork groups	28-64 22-353-188-499-545-414-232-337, 453,	-57 -71 -22 382 200 538 556 222 491 491 481 491 481
in Montered County in Monterey County in Orange County in Sacramento County in San Diego County in San Joaquin County in San Luis Obispo County in Santa Barbara County in Sishiyou County in Siskiyou County in Stanislaus County in Stanislaus County in Ventura County Norcross Chrome Mine North Central Region, Siskiyou County Hubbard Mine (see Ready Relief). Star Mine Northern California Dredge Company N. T. U. Company, The Nuvida Mineral Spring  Oak Bar Dredge Bottom Placer Syndicate Flat and East Fork groups Grove Tungsten Mine	28-64-25-353-3-188-35-499-345-32-337, 453, 453, 453, 453, 454-35-35-35-35-35-35-35-35-35-35-35-35-35-	-57 -71 -22 382 200 538 556 222 456 533 491 481 481 481 481 481 481 481
in Montered County in Monterey County in Orange County in Sacramento County in San Diego County in San Joaquin County in San Joaquin County in San Luis Obispo County in Santa Barbara County in Siskiyou County in Stanislaus County in Stanislaus County in Ventura County Norcross Chrome Mine Nordheimer Placer Mine North Central Region, Siskiyou County Hubbard Mine (see Ready Relief) Star Mine Northern California Dredge Company N. T. U. Company, The Nuvida Mineral Spring  Oak Bar Dredge Bottom Placer Syndicate Flat and East Fork groups Grove Tungsten Mine Oakdale Ranch deposit	28-64 22-353-188-499-545-414-204-232-337, 453,	-57 -71 -22 382 200 538 495 533 4490 5559 491 481 481 3353 353
in Monterey County in Monterey County in Orange County in Sacramento County in San Diego County in San Joaquin County in San Joaquin County in San Luis Obispo County in Santa Barbara County in Siskiyou County in Stanislaus County in Stanislaus County in Ventura County Norcross Chrome Mine Northeimer Placer Mine North Central Region, Siskiyou County Hubbard Mine (see Ready Relief) Star Mine Northern California Dredge Company N. T. U. Company, The Nuvida Mineral Spring Oak Bar Dredge Bottom Placer Syndicate Flat and East Fork groups Grove Tungsten Mine Oakdale Ranch deposit Occidental group.	28-64 22-353-188-499-545-414-204-232-337, 453,	-57 -71 -22 382 200 5388 556 22 24 556 22 491 481 353 353 353 358 288
in Montered County in Monterey County in Saramento County in Saramento County in San Diego County in San Joaquin County in San Luis Obispo County in Santa Barbara County in Sishiyou County in Sishiyou County in Stanislaus County in Ventura County Norcross Chrome Mine Northern Region, Sishiyou County Hubbard Mine (see Ready Relief). Star Mine Northern California Dredge Company N. T. U. Company, The Nuvida Mineral Spring  Oak Bar Dredge Bottom Placer Syndicate Flat and East Fork groups Grove Tungsten Mine Oakdale Ranch deposit Occidental group Oceanie Mine Oceanie Mine	28-64 22-353-188-499-545-414-204-232-337, 453,	-57 -71 -22 382 200 538 495 533 4490 5559 491 481 481 3353 353
in Montered County in Monterey County in Orange County in Sacramento County in San Diego County in San Joaquin County in San Joaquin County in Santa Barbara County in Santa Barbara County in Siskiyou County in Stanislaus County in Stanislaus County in Ventura County Norcross Chrome Mine Nordheimer Placer Mine North Central Region, Siskiyou County Hubbard Mine (see Ready Relief) Star Mine Northern California Dredge Company N. T. U. Company, The Nuvida Mineral Spring  Oak Bar Dredge Bottom Placer Syndicate Flat and East Fork groups Grove Tungsten Mine Oakdale Ranch deposit Occanic Mine Occanic Mine Oceanic Mine	28-64 22-353-188-499-545-414-204-232-337, 453,	-57 -71 -22 382 200 5388 556 22 24 556 22 491 481 353 353 353 358 288
in Montered County in Monterey County in Orange County in Sacramento County in San Diego County in San Joaquin County in San Joaquin County in San Luis Obispo County in Santa Barbara County in Siskiyou County in Stanislaus County in Stanislaus County in Ventura County Norcross Chrome Mine Northeimer Placer Mine North Central Region, Siskiyou County Hubbard Mine (see Ready Relief) Star Mine Northern California Dredge Company N. T. U. Company, The Nuvida Mineral Spring Oak Bar Dredge Bottom Placer Syndicate Flat and East Fork groups Grove Tungsten Mine Oakdale Ranch deposit Occidental group Oceanic Mine Ocean View Mine (see Plaskett). Ocher (see Mineral Paint).	28-64 22-353-188-499-545-414-204-232-337, 453,	-57 -71 -22 382 200 5388 556 22 24 556 22 491 481 353 353 353 358 288
in Montered County in Monterey County in Orange County in Sacramento County in San Diego County in San Joaquin County in San Joaquin County in San Luis Obispo County in Santa Barbara County in Siskiyou County in Stanislaus County in Stanislaus County in Ventura County Norcross Chrome Mine Northeimer Placer Mine North Central Region, Siskiyou County Hubbard Mine (see Ready Relief) Star Mine Northern California Dredge Company N. T. U. Company, The Nuvida Mineral Spring Oak Bar Dredge Bottom Placer Syndicate Flat and East Fork groups Grove Tungsten Mine Oakdale Ranch deposit Occidental group Oceanic Mine Ocean View Mine (see Plaskett). Ocher (see Mineral Paint).	28-64 22-353-188-499-545-414-204-232-337, 453,	-57 -71 -22 382 200 5388 556 22 24 556 22 491 481 353 353 353 358 288
in Montered County in Monterey County in Orange County in Sacramento County in San Diego County in San Joaquin County in San Luis Obispo County in Santa Barbara County in Sishiyou County in Stanislaus County in Stanislaus County in Ventura County Norcross Chrome Mine Northern Region, Siskiyou County Hubbard Mine (see Ready Relief). Star Mine Northern California Dredge Company N. T. U. Company, The Nuvida Mineral Spring  Oak Bar Dredge Bottom Placer Syndicate Flat and East Fork groups Grove Tungsten Mine Oakdale Ranch deposit Occidental group Oceanic Mine Ocean View Mine (see Plaskett). OChen (see Mineral Paint). O'Donnell & Burns Mining Company	28-64 22-353-188-499-545-414-204-232-337, 453,	-57 -57 -22 -38 -22 -22 -38 -22 -22 -23 -38 -38 -38 -38 -38 -38 -38 -38 -38 -3
in Montered County in Monterey County in Orange County in Sacramento County in San Diego County in San Joaquin County in San Joaquin County in San Luis Obispo County in Santa Barbara County in Siskiyou County in Stanislaus County in Stanislaus County in Ventura County Norcross Chrome Mine Northeimer Placer Mine North Central Region, Siskiyou County Hubbard Mine (see Ready Relief) Star Mine Northern California Dredge Company N. T. U. Company, The Nuvida Mineral Spring Oak Bar Dredge Bottom Placer Syndicate Flat and East Fork groups Grove Tungsten Mine Oakdale Ranch deposit Occidental group Oceanic Mine Ocean View Mine (see Plaskett). Ocher (see Mineral Paint).	28-64 22-353-188-499-545-414-204-232-337, 453,	-57 -57 -22 -382 -220 -382 -220 -538 -538 -538 -491 -491 -491 -491 -491 -491 -491 -491

		]	Page
Oil field development operations72-76, 246-250,	383-389	, 563-	-567
in Alameda County			909
in Colusa County			383
in Fresno Countyin Kern County	79 946	. 240, 383	563
in Kings County	_12, 210,	73.	384
in Los Angeles County	_73, 247,	384,	564
in Merced County			387
in Nana County		75.	387
in Orange County	75, 249,	388,	500
in Riverside Countyin San Benito County			
in San Bernardino County	75. 249.	388.	567
in San Diego County			75
in San Joaquin County			388
in San Luis Obispo County	75, 249,	388,	567
in San Mateo Countyin Santa Barbara County	75 250	$\frac{249}{200}$	567
in Santa Cruz County	_10, 200,	, 900,	388
in Tulare County	75.	388.	567
in Tulare County in Ventura County	76, 250,	388,	567
in Yolo Countyshale deposits of Santa Ynez River Region			76
shale deposits of Santa Ynez River Region			561
in San Luis Obispo County			
in Santa Barbara CountyOil wells in 1924, number of		_000	401
Ojai Gypsum Mine			239
Mine			233
Old Calaveras group			
Dominion Mine			
Highland MineStiff Mine			
Vet and Eclipse group			453
One Hundred Dollar prospect			453
O'Neill Ranch Placer			481
Ontario Springs			526
Onyx in Siskiyou County			597
and travertine, 1924 production of			263
Opals in Calaveras County			170
Ora Anna Quartz Mine			291
Orange County Brick and Tile Company			66
Coal Mining Company			
general description geology			
mineral resources of		5	
table of			60
oil field development in	75, 249,	, 388,	566
Rock Company, Inc.			369
Orbicular Gabbro in San Diego County Orcutt Hydraulic Mine			310
Placer Mine			482
Oregon Mine		41,	453
Oregonian group		$_{-}450,$	453
Orella Estate Quarry			562
Orestimba Mining Company Oriental copper claim			288
Quartz Mine			453
Oriflamme Mine			345
Orleans Bar MineOrnamental stones in Siskiyou County			310
Ornamental stones in Siskiyou County			493
Oro Fino Mine		452	
Grande MineOsborne feldspar deposit			359
silica deposit			
Osceola prospect Osgood Mine			455
Osgood Mine			454
Osmiridium (see platinum metals).			
Otaylite (see fuller's earth). Otay sand deposit			55
Outlook Mine			455
Overton Mine			455
Owens Mine			345
Owl claim			286

	Page
Pacific Asbestos Corporation	164
Clay Products Company	356
Diatom Products Company	36
Gold Mining and Milling Company (see Easyz Bird Mine).	
Rock Granite Company (see Angels Greenstone Company).	
Sanitary Manufacturing Company	358
Porcelain Company	
Paddy Cronin Mine	
Paine Mine	
Pala Chief Gem Mine	362
Mining Company 362	, 363
lepidolite deposit	374
Paloma Mining Company	
Panama pottery	482
Paraiso Hot Springs	
Park & Brown Mine	279
Parker Brick Company's plant	547
group	
PlacerParkfield district, gold in	
Paso Robles Hot Springs	526
Mud Bath Springs	526
Mud Bath Springs Patent Process claims of Wakama Iron and Steel Company	518
Patriquin-Gillett Quicksilver Mining Company	51
Quicksilver Mine (see Paloma Mining Company). Patton Mine	231
Peacock Mining Company 310	-315
sluice and riffle construction at	316
Pearch Creek prospect	. 308
Mine	315
Pecho Warm Springs Peg Leg Mine	120
Peirano saanstone property	171
Peirano soapstone property	167
Pennsylvania Placer	482
Peoples Lumber Company brick and tile plant	. 237
Pereira group Personnel, changes in 122, 258	207
Peters, Frank, gas well	320
Peterson Mine (see Joubert Placer Mines).	020
Placer Mine	482
Petroleum, 1924 production of399	-401
in Humboldt County	321
in Merced Countyin Monterey County	50
in Orange County	68
in Sacramento County	. 10
in San Diego County	380
in San Joaquin County	195
in San Lui Obispo Countyin Santa Barbara County	561
in Stanislaus County	214
in Ventura County	. 242
proved oil land	401
Phelan Ranch deposits	523
Phosphates in Ventura CountyPick & Shovel Mine	508
Pilot Knob & Kearsarge claims	456
Mine	455
Pine Grove Placer	. 482
Pine Mountain group	5,534
Nut Mine Pinkham's Santa Barbara Mineral Springs	555
Pismo Heights Company's deposit	513
Pismo Heights Company's deposit  Placer County, ancient channels of the Duncan Canyon region  275	-280
mines (see also under Gold).	
in Calaveras County	. 161
in Siskiyou County	
Plaskett Mine	. 41

	Page
Platinum metals, 1924 production of	263
in Calaveras County	163
in Del Norte County	293
in Humboldt Countyin Merced County	181
in Sacramento County	22
in San Joaquin County	191
in San Luis Obispo County	528
in Santa Barbara County541	
in Siskiyou Countyin Stanislaus County	
in Ventura County	232
(see also black sand)	
Point Sal deposit	552
Poker Flat dredger	
Polar Star MinePond Water Mine	189
Pombury Dika Mina	456
Porphyry Dike Mine————————————————————————————————————	. 100
Porter Ranch manganese deposit	319
Porters Bar Dredging Company	491
Portuguese Mine	482
Positions wanted, list of133, 274, 411 Potash, 1924 production of	, 595
Potrero silica deposit	376
Pottery clay (see Clay).	. 010
Pratt Building Material Company1	9, 55
Prattee Sand Pit No. 4	55
Pratt Rock and Gravel Company	. 20
Preston iron property	
manganese deposit	319
Prince property (see Tollgate Mine).	. 010
Prodical Son copper claim	. 511
Producers and consumers 132, 273, 410	
Progressive Placer Mine	489
Prospect Hill Mine Proved oil land in 1924	
Providence Mine	456
Providence Mine	9-593
Pumice, 1924 production of	. 582
in Siskiyou County	
Punta Gorda Mine————————————————————————————————————	. 233
ryrites, 1924 production of	. 204
Quartz Gulch Placer	
Hill Mine456	6, 483
, industrial:	170
in Calaveras County in San Diego County	
in Stanislaus County	
Mines (see Gold).	
Queen Bee Mine	. 514
Quicksilver, 1924 production of	264
in Del Norte County	
in Merced County	
in Monterey County	
in Orange County	. 62
in San Luis Obispo County526	9-535
in Santa Barbara County	542
in Siskiyou Countyin Stanislaus County	$\frac{495}{215}$
An Avenue County	_ 210
Rainbow copper group	305
Mine	456
Ramona molybdenum deposits	351
Ramus, Joe, PlacerRanch Mine (see Sherman Ranch Mine).	469
Ranchita Mine	346
Rancho Piedra Blanca	508
Santa Manuela	508
Santa Rita	510
15—42102	

Paymond R W gited		147
Raymond, R. W., cited		0.40
Ready Relief and North Hubbard Mines		346
Red Can Mine 3	05.	308
Quartz and Placer Mining Company	οο,	200
Quartz and Flacer Mining Company		308
Hill Mine4	56,	479
Mountain Magnesite Company (see California Magnesite Company)		
Hill Mine  Mountain Magnesite Company (see California Magnesite Company).  Raphymy Mign		915
rorphyry mme		315
Rock group of claims		231
Rock group of claimsQuicksilver Mining Company (see Acachuma Mine).		
Quicksiver winning Company (see Acachuma wine).		
Star prospect		280
Top Mine, Inc.		157
TOP Willie, Inc.		101
prospect		157
Reeder group		456
Reeves Ranch Placer		
Refineries Clay Company		546
Pofugio conner claim		511
Relugio copper ciaimi		011
Refugio copper claim  Regulation of dealers in gold-silver ores and bullion, act providing for  3	592-	396
Reichman Mercantile Company4	50	469
Reynolds Creek Mine		411
Rhoden, D. F., ocher deposit		168
Riccioli manganese property		594
		JAT
Ricketts, A. H.		77
Riewerts deposit		36
Riley Ranch deposit		28
Rinconada Mine		534
Rincon Mine		922
Kincon Mine		200
Rindge, F. H., property		157
Riverbank Sand Company's property		197
D' D 1 C 1 C 1 C 1 C 1 C 1 C 1 C 1 C 1 C 1		100
River Rock Gravel Company		198
River Rock Gravel Company Riverside brick yard (see Sacramento Brick Company). County, Oil field development in		
County Oil field development in	999	566
County, On held development in	,00	000
Roanoke Mining Company (see Lamphear Mine).		
Robertson Mine (see Barnum Bros. Quartz Mine).		
tober took with See Darman Dros. Quarta withey.		100
& Carpenter Mine		466
Robinson Gulch prospect		456
mmonnet		279
prospect		200
Rock, crushed (see Stone, miscellaneous).		
		170
crystal in Calaveras County		170
crystal in Calaveras County & gravel industry:		
crystal in Calaveras County & gravel industry:		
erystal in Calaveras County & gravel industry: in Calaveras County		169
crystal in Calaveras County		169 294
crystal in Calaveras County		169 294 321
crystal in Calaveras County		169 294 321 182
crystal in Calaveras County		169 294 321 182
crystal in Calaveras County		169 294 321 182 53
crystal in Calaveras County		169 294 321 182 53 69
crystal in Calaveras County		169 294 321 182 53 69
crystal in Calaveras County		169 294 321 182 53 69 377
crystal in Calaveras County		169 294 321 182 53 69 377 196
crystal in Calaveras County		169 294 321 182 53 69 377 196
crystal in Calaveras County		169 294 321 182 53 69 377 196 217
crystal in Calaveras County & gravel industry: in Calaveras County in Del Norte County in Humboldt County in Merced County in Monterey County in Orange County in Orange County in San Diego County in San Diego County in San Joaquin County in Stanislaus County in Stanislaus County		169 294 321 182 53 69 377 196 217 244
crystal in Calaveras County & gravel industry: in Calaveras County in Del Norte County in Humboldt County in Merced County in Monterey County in Orange County in Osan Diego County in San Diego County in San Joaquin County in Stanislaus County in Stanislaus County Stanislaus County in Secky Point Mine	315,	169 294 321 182 53 69 377 196 217 244 484
crystal in Calaveras County & gravel industry: in Calaveras County in Del Norte County in Humboldt County in Merced County in Monterey County in Orange County in Osan Diego County in San Diego County in San Joaquin County in Stanislaus County in Stanislaus County Stanislaus County in Secky Point Mine	315,	169 294 321 182 53 69 377 196 217 244 484
crystal in Calaveras County & gravel industry: in Calaveras County in Del Norte County in Humboldt County in Merced County in Monterey County in Orange County in San Diego County in San Diego County in San Joaquin County in Stanislaus County in Stanislaus County Stanislaus County In Sean Stanislaus County In Stanislaus County In Sean Stanislaus County In Sean Stanislaus County In Sean Stanislaus County In Sean Stanislaus County In Ventura County Rocky Point Mine Rollin Mining Company	315,	169 294 321 182 53 69 377 196 217 244 484 458
crystal in Calaveras County & gravel industry:     in Calaveras County     in Del Norte County     in Humboldt County     in Merced County     in Monterey County     in Orange County     in San Diego County     in San Diego County     in San Joaquin County     in Stanislaus County     in Stanislaus County     Rocky Point Mine Rollin Mining Company Ronning quartz prospect	315,	169 294 321 182 53 69 377 196 217 244 484 458 457
crystal in Calaveras County & gravel industry:     in Calaveras County     in Del Norte County     in Humboldt County     in Merced County     in Monterey County     in Orange County     in San Diego County     in San Diego County     in San Joaquin County     in Stanislaus County     in Stanislaus County     Rocky Point Mine Rollin Mining Company Ronning quartz prospect	315,	169 294 321 182 53 69 377 196 217 244 484 458 457
crystal in Calaveras County & gravel industry: in Calaveras County in Del Norte County in Humboldt County in Merced County in Monterey County in Orange County in San Diego County in San Joaquin County in San Joaquin County in Stanislaus County in Stanislaus County Rocky Point Mine Rollin Mining Company Ronning quartz prospect Rosalina Placer Mine	315,	169 294 321 182 53 69 377 196 217 244 458 457 315
crystal in Calaveras County & gravel industry: in Calaveras County in Del Norte County in Humboldt County in Merced County in Monterey County in Orange County in San Diego County in San Joaquin County in Stanislaus County Rocky Point Mine Rollin Mining Company Ronning quartz prospect Rosalina Placer Mine Ross & Mann Drift Mine	315,	169 294 321 182 53 69 377 196 217 244 458 457 315 477
crystal in Calaveras County & gravel industry: in Calaveras County. in Del Norte County. in Humboldt County. in Merced County. in Monterey County. in Orange County. in San Diego County. in San Joaquin County. in Stanislaus County. in Stanislaus County. in Ventura County. Rocky Point Mine Rosky Mann Drift Mine Ross & Mann Drift Mine Rossi granite quarry.	315,	169 294 321 182 53 69 377 196 217 244 458 457 315 477 367
crystal in Calaveras County & gravel industry: in Calaveras County. in Del Norte County. in Humboldt County. in Merced County. in Monterey County. in Orange County. in San Diego County. in San Joaquin County. in Stanislaus County. in Stanislaus County. in Ventura County. Rocky Point Mine Rosky Mann Drift Mine Ross & Mann Drift Mine Rossi granite quarry.	315,	169 294 321 182 53 69 377 196 217 244 458 457 315 477 367
crystal in Calaveras County & gravel industry: in Calaveras County in Del Norte County in Humboldt County in Merced County in Monterey County in Orange County in San Diego County in San Joaquin County in San Joaquin County in Stanislaus County in Ventura County Rocky Point Mine Roslin Mining Company Ronning quartz prospect Ross & Mann Drift Mine Ross granite quarry Rough & Ready Placer Mine	315,	169 294 321 182 53 69 377 196 217 244 458 457 315 477 367 317
crystal in Calaveras County & gravel industry: in Calaveras County in Del Norte County in Humboldt County in Merced County in Monterey County in Orange County in San Diego County in San Joaquin County in Stanislaus County Rocky Point Mine Rosky Point Mine Rossi granite quarty prospect Rossi granite quarry Rough & Ready Placer Mine Rosbury Placer Mine Roxbury Placer Mine	315,	1699 2944 3211 1822 53 69 3777 1966 2177 2444 4548 4577 3677 3677 3677 484
crystal in Calaveras County & gravel industry: in Calaveras County in Del Norte County in Humboldt County in Merced County in Monterey County in Orange County in San Diego County in San Joaquin County in Stanislaus County Rocky Point Mine Rosky Point Mine Rossi granite quarty prospect Rossi granite quarry Rough & Ready Placer Mine Rosbury Placer Mine Roxbury Placer Mine	315,	1699 2944 3211 1822 53 69 3777 1966 2177 2444 4548 4577 3677 3677 3677 484
crystal in Calaveras County & gravel industry: in Calaveras County in Del Norte County in Humboldt County in Merced County in Monterey County in Orange County in San Diego County in San Diego County in San Joaquin County in Stanislaus County in Stanislaus County in Stanislaus County Stanislaus County in Ventura County Rocky Point Mine Rollin Mining Company Ronning quartz prospect Rossalina Placer Mine Rossi granite quarry Rough & Ready Placer Mine Roxbury Consolidated Mines	315,	169 294 321 182 53 69 377 196 217 244 484 457 315 477 367 317 484 157
crystal in Calaveras County & gravel industry: in Calaveras County in Del Norte County in Humboldt County in Merced County in Monterey County in Orange County in San Diego County in San Joaquin County in San Joaquin County in Stanislaus County in Ventura County Rocky Point Mine Rosky Point Mine Ross & Mann Drift Mine Ross & Mann Drift Mine Rossi granite quarry Rough & Ready Placer Mine Roxbury Placer Mine Roxbury Placer Mine Roxbury Placer Mine Royal Consolidated Mines	315,	169 294 321 182 53 69 377 196 217 244 458 457 315 477 367 484 157 373
crystal in Calaveras County & gravel industry: in Calaveras County in Del Norte County in Humboldt County in Merced County in Monterey County in Orange County in Orange County in San Diego County in San Joaquin County in San Joaquin County in Stanislaus County in Stanislaus County in Stanislaus County in Sean Joaquin County in Stanislaus County in Stanislaus County in Sean Joaquin County in Stanislaus County in Sean Joaquin County in Stanislaus County in Sean Joaquin County in Sean Joaquin County in Sean Joaquin County in Sean Joaquin County Rocky Point Mine Rossi granite quarry Rough & Ready Placer Mine Roxbury Basin Mine	315,	169 294 321 182 53 69 317 217 244 484 457 315 477 367 317 487 487 317 487
crystal in Calaveras County & gravel industry: in Calaveras County in Del Norte County in Humboldt County in Merced County in Monterey County in Orange County in Orange County in San Diego County in San Joaquin County in San Joaquin County in Stanislaus County in Stanislaus County in Stanislaus County in Sean Joaquin County in Stanislaus County in Stanislaus County in Sean Joaquin County in Stanislaus County in Sean Joaquin County in Stanislaus County in Sean Joaquin County in Sean Joaquin County in Sean Joaquin County in Sean Joaquin County Rocky Point Mine Rossi granite quarry Rough & Ready Placer Mine Roxbury Basin Mine	315,	169 294 321 182 53 69 317 217 244 484 457 315 477 367 317 487 487 317 487
crystal in Calaveras County & gravel industry: in Calaveras County in Del Norte County in Humboldt County in Merced County in Monterey County in Orange County in San Diego County in San Diego County in San Joaquin County in Stanislaus County in Stanislaus County in Stanislaus County Stanislaus County in Ventura County Rocky Point Mine Rollin Mining Company Ronning quartz prospect Rossalina Placer Mine Rossi granite quarry Rough & Ready Placer Mine Roxbury Placer Mine Roxbury Placer Mine Roxbury Consolidated Mines Mine Ruby Basin Mine Placer Mine	315,	169 294 321 182 53 69 377 196 217 244 484 457 315 477 367 317 484 157 373 444
crystal in Calaveras County & gravel industry: in Calaveras County in Del Norte County in Humboldt County in Merced County in Monterey County in Orange County in San Diego County in San Joaquin County in San Joaquin County in Stanislaus County in Stanislaus County in Stanislaus County Rocky Point Mine Rollin Mining Company Ronning quartz prospect Rossalina Placer Mine Ross & Mann Drift Mine Ross & Mann Drift Mine Rosbury Placer Mine Roxbury Placer Mine Roxbury Placer Mine Roxbury Basin Mine Ruby Basin Mine Rulon Placer	315,	169 294 321 182 53 69 377 196 217 244 457 367 317 484 157 373 447 414 484
crystal in Calaveras County & gravel industry: in Calaveras County in Del Norte County in Humboldt County in Merced County in Monterey County in Orange County in San Diego County in San Joaquin County in San Joaquin County in Stanislaus County in Stanislaus County in Stanislaus County Rocky Point Mine Rollin Mining Company Ronning quartz prospect Rossalina Placer Mine Ross & Mann Drift Mine Ross & Mann Drift Mine Rosbury Placer Mine Roxbury Placer Mine Roxbury Placer Mine Roxbury Basin Mine Ruby Basin Mine Rulon Placer	315,	169 294 321 182 53 69 377 196 217 244 457 367 317 484 157 373 447 414 484
crystal in Calaveras County & gravel industry: in Calaveras County in Del Norte County in Humboldt County in Merced County in Monterey County in Orange County in San Diego County in San Joaquin County in San Joaquin County in Stanislaus County in Stanislaus County in Stanislaus County Rocky Point Mine Rollin Mining Company Ronning quartz prospect Rossalina Placer Mine Ross & Mann Drift Mine Ross & Mann Drift Mine Rosbury Placer Mine Roxbury Placer Mine Roxbury Placer Mine Roxbury Basin Mine Ruby Basin Mine Rulon Placer	315,	169 294 321 182 53 69 377 196 217 244 457 367 317 484 157 373 447 414 484
crystal in Calaveras County & gravel industry: in Calaveras County in Del Norte County in Humboldt County in Merced County in Monterey County in Orange County in San Diego County in San Joaquin County in San Joaquin County in Stanislaus County in Stanislaus County in Ventura County Rocky Point Mine Rollin Mining Company Ronning quartz prospect Rosalina Placer Mine Ross & Mann Drift Mine Rossi granite quarry Rough & Ready Placer Mine Roxbury Placer Mine Roxburg Placer Mine Roxburg Consolidated Mines Mine Placer Mine Rulon Placer Russ chrome deposit Russel Borate Mining Company	315,	169 294 321 1822 533 69 377 196 217 244 485 457 315 447 367 373 447 41 484 510 235
crystal in Calaveras County & gravel industry: in Calaveras County in Del Norte County in Humboldt County in Merced County in Monterey County in Monterey County in San Diego County in San Diego County in San Joaquin County in San Joaquin County in Stanislaus County in Ventura County Rocky Point Mine Rollin Mining Company Ronning quartz prospect Rosalina Placer Mine Ross & Mann Drift Mine Ross & Mann Drift Mine Ross i granite quarry Rough & Ready Placer Mine Roxbury Placer Mine Roxbury Placer Mine Royal Consolidated Mines Mine Ruby Basin Mine Placer Mine Ruby Basin Mine Ruby Basin Mine Rulon Placer Russ chrome deposit Russell Borate Mining Company Mine	315,	169 294 321 1822 533 69 377 196 217 244 484 457 315 4477 367 347 484 4157 373 447 414 484 548 548 548 548 548 548 548 548 54
crystal in Calaveras County & gravel industry: in Calaveras County in Del Norte County in Humboldt County in Merced County in Monterey County in Monterey County in San Diego County in San Diego County in San Joaquin County in San Joaquin County in Stanislaus County in Ventura County Rocky Point Mine Rollin Mining Company Ronning quartz prospect Rosalina Placer Mine Ross & Mann Drift Mine Ross & Mann Drift Mine Ross i granite quarry Rough & Ready Placer Mine Roxbury Placer Mine Roxbury Placer Mine Royal Consolidated Mines Mine Ruby Basin Mine Placer Mine Ruby Basin Mine Ruby Basin Mine Rulon Placer Russ chrome deposit Russell Borate Mining Company Mine	315,	169 294 321 1822 533 69 377 196 217 244 484 457 315 4477 367 347 484 4157 373 447 414 484 548 548 548 548 548 548 548 548 54
crystal in Calaveras County & gravel industry: in Calaveras County in Del Norte County in Humboldt County in Merced County in Monterey County in Orange County in San Diego County in San Joaquin County in San Joaquin County in Stanislaus County in Stanislaus County in Ventura County Rocky Point Mine Rollin Mining Company Ronning quartz prospect Rosalina Placer Mine Ross & Mann Drift Mine Rossi granite quarry Rough & Ready Placer Mine Roxbury Placer Mine Roxburg Placer Mine Roxburg Consolidated Mines Mine Placer Mine Rulon Placer Russ chrome deposit Russel Borate Mining Company	315,	169 294 321 1822 533 69 377 196 217 244 484 457 315 4477 367 347 484 4157 373 447 414 484 548 548 548 548 548 548 548 548 54

	1	Page
Sacramento Brick Company Clay Products Company (See Cannon and Company's pottery).		9
Clay Products Company (See Cannon and Company's pottery).  County		1
bibliography		$-2^{\frac{1}{2}}$
geography and topography		1
mineral production, table of		4
mineral resources of	6	2-22
Field Division1-22, 135-172 275-280,	413-	-498
Gas Company		11
Mortar and Sand Company Sand Company (see Capitol Sand and Gravel Company).		21
Safety Chrome Mine		508
Safety Chrome MineSale of gold—silver ores and bullion, Act regulating	392	-396
Salmon River district		419
Salsipuedes Ranch deposit		
Salstrom Placer Mine		317
Salt Cake (see Sodium Sulphate).		583
Salt, 1924 production ofin Monterey County		
Salt Lake-California Mine		288
Salt Lake-California Mine-San Benito County, Oil field development in	249.	566
San Bernardino County, Oil field development in	588,	567
Creek deposit		510
Sanborn, Frank L. 124, 266,	402,	588
San Carpajano Creek deposit		510
Sand: in Calaveras County		169
in Merced County		
in Monterey County	54	4-56
in Orange County		71
in San Diego County	374,	377
in San Joaquin County		
in San Luis Obispo County		535
in Stanislaus County		217
in Ventura County_ and gravel, 1924 production of , foundry, California		585
, foundry, California	251	-255
, molding:		
in Sacramento County		21
in Ventura County		241
Sand, refractory		41
San Diego Brick and Tile Company		356
County:		000
description		325
geology	326,	332
metals in	329-	-353
metals in mineral production, table of mineral resources	207	328
nonmetals in	353.	-382
oil field development in	999	75
physiography		326
Water Company (see Bernardo Granite Quarries).		
property, lepidolite in		373
Sandstone, 1924 production of		583
in Calaveras County in Santa Barbara County		171
in Siskiyou County		497
in Ventura County		
ornamental, in Siskiyou County		493
Sanford & Edmundson claim		485
Sanford & Edmundson claim San Francisco Field Division 23–57, 173–222, 281–324.	499-	-538
Sanger Peak copperSan Jacinto Mining and Milling Company (See Daly copper mine).		288
San Jacinto Mining and Milling Company (See Daly copper mine).  San Joaquin Brick Company		188
County.	184	
geography and geology		184
geography and geology mineral production, table of		186
mineral resources		184
oil field development in		388

· · · · · · · · · · · · · · · · · · ·	rage
San Jose Valley Mine.	534
San Luis Brick Company	505
Works.	505
Hot Springs	500
Obispo County:	320
geography.	400
geography	499
geology mineral resources of	500
mineral resources of500-	-538
oil field development in75, 249, 388,	567
on field development in	499
San Marcus Cold Springs	556
San Mateo County Oil field development in 75 240	200
San Miguelite Conven denosit	500
San Miguel to Canyon deposit	993
Santa Ana Mines	59
Mining Company	59
Rock and Gravel Company	70
Santa Barbara Builders Supply Company	547
Canyon deposit	552
County:	002
	F20
climate	539
mineral production, table of	541
mineral resources of	-562
oil field development in 75 250 388	-567
streams and water shipping	539
topography	539
transportation	540
transportation	010
Santa Clara Mine	F9.4
Santa Clara Mine	534
Santa Cruz County, Oil filed developments in	388
MineSanta Fe gravel pit (see Riverbank Sand Company's property).	531
Santa Fe gravel pit (see Riverbank Sand Company's property).	
Santa Lucia Mining Corporation (see Rinconada Mine).	
Santa Maria Mine	533
Santa Monica claim (see Capitola Mine).	000
Santa Susana Orani (see Capitola Mille).	0.42
Santa Susana Quarry Santa Ynez River region, oil shale deposits in	243
Santa Ynez River region, oil shale deposits in	561
Santa Ysabel Springs	527
Santa Ysabel Springs Santiago Coal Mine San Vicente Grant copper deposits	67
San Vicente Grant copper deposits	330
gold deposits	333
silica deposits	376
Satellite Conner Mine havite in	164
Satellite Copper Mine, barite in	104
Saticoy Rock Company	244
Sauerkraut Placer Mine Savoy, Dave, Placer Mine	485
Savoy, Dave, Placer Mine	291
Scheelite (see tungsten).	
Sehley group	348
Schneider and McCles claim	511
Schofield Copper Mine.	000
Schon & Blaylock Placer	
Schroeder Mine	457
Schuler Mine	485
Scioc Mine	457
Scott Bar & Golden Rule claims	474
River region, Siskiyou County	416
Tom Mino	340
, Tom, Mine	206
Senate Dill No. 157	-390
Serrano manganese deposit	524
Service Bros. gravel pit	222
Sespe Canyon brownstone quarry	244
Severtson, Hans, gravel plant	380
Sever Graphite Mine	369
Service Bros. gravel pit.  Sespe Canyon brownstone quarry.  Severtson, Hans, gravel plant.  Seyer Graphite Mine.  Shadows Creek Placer Mine.	485
Shale oil (see Oil Shale),	100
	450
Shasta Mine	453
§ prings	493
View asbestos prospect	421
Sheep Ranch Mine	158
Sherman Ranch Mine	159
Shumway Mine	485
Sighlar Com Mine	362
Sickler Gem Mine	591
Sierra Morena Mine	466
Sightman Placer Mine	400

C111 4004 7 11 11	Page
Silica, 1924 production of	583
in San Diego County	
in Stanislaus County	216
Silver, 1924 production of	
in Humboldt Coun y	
in Merced County	
in Monterey Count	
in Orange County	
in San Diego County	
in San Joaquin County	191
in Stanislaus County	206
King Mine	
Swan Mine	
Simpson-Pirnie Granite Company 366	367
Siskiyou Coal and Coke Company	420
County:	400
bibliography of	498
geogr phy	414
geology and mineral resources	. 415
Elliott Creek district	420
Klamath River district	418
North Central region.	416
Salmon River district	410
Cast Diver nation	416
Scott River region	410
mineral production, table of	422
mineral resources of414	-498
Dredging Company.	. 491
Gold Mines Company	457
Mines Company	486
River Bend Mine	487
Syndicate (see Cub Bear and Blue Jeans prospects).	. 10.
Six-Mile Creek Placer	197
SIA-MIRE Creek Flacer	- 401
Sky Scraper copper claim	. 512
Slab Ranch property	161
Slate, in Calaveras County	. 171
Slate's Hot Springs	. 47
Slide Creek Mine	464
Slim Jim Quartz MineSluice and riffle construction, Peacock Mining Company	457
Sluice and riffle construction, Peacock Mining Company	316
Snowball Placer	187
Snowflake and Little Gem quartz claims	457
Snow group	. 545
Soanstone 1024 production of	
Soapstone 1924 production of	. 400
in Calaveras County	. 171
in Calaveras County in Siskiyou County	$\frac{171}{497}$
in Calaveras County in Siskiyou County Soda. 1924 production of	$\begin{array}{c} 171 \\ 497 \\ 265 \end{array}$
in Calaveras County in Siskiyou County Soda. 1924 production of	$\begin{array}{c} 171 \\ 497 \\ 265 \end{array}$
in Calaveras County	. 171 497 . 265 . 535
in Calaveras County	171 497 265 535 182
in Calaveras County. in Siskiyou County. Soda, 1924 production of Lake niter, in Merced County. Sodium sulphate, in San Luis Obispo County.	. 171 497 . 265 . 535 . 182 . 535
in Calaveras County. in Siskiyou County. Soda, 1924 production of. Lake. niter, in Merced County. Sodium sulphate, in San Luis Obispo County. Southern California Mining and Smelting Company.	. 171 497 . 265 . 535 . 182 . 535 . 330
in Calaveras County in Siskiyou County Soda, 1924 production of Lake niter, in Merced County Sodium sulphate, in San Luis Obispo County Southern California Mining and Smelting Company Pacific Company	171 497 265 535 182 535 330 457
in Calaveras County in Siskiyou County Soda, 1924 production of Lake niter, in Merced County Sodium sulphate, in San Luis Obispo County Southern California Mining and Smelting Company Pacific Company Quarry	171 497 265 535 182 535 330 457
in Calaveras County. in Siskiyou County. Soda, 1924 production of. Lake niter, in Merced County. Sodium sulphate, in San Luis Obispo County. Southern California Mining and Smelting Company. Pacific Company. Quarry. South Mountain deposit. 238, 238	171 497 265 535 182 535 330 457 537 9, 241
in Calaveras County. in Siskiyou County. Soda, 1924 production of. Lake niter, in Merced County. Sodium sulphate, in San Luis Obispo County. Southern California Mining and Smelting Company. Pacific Company. Quarry. South Mountain deposit. 238, 238	171 497 265 535 182 535 330 457 537 9, 241
in Calaveras County. in Siskiyou County. Soda, 1924 production of. Lake niter, in Merced County. Sodium sulphate, in San Luis Obispo County. Southern California Mining and Smelting Company. Pacific Company. Quarry. South Mountain deposit. 238, 238	171 497 265 535 182 535 330 457 537 9, 241
in Calaveras County. in Siskiyou County. Soda, 1924 production of. Lake. niter, in Merced County. Sodium sulphate, in San Luis Obispo County. Southern California Mining and Smelting Company. Pacific Company. Quarry. South Mountain deposit. 238, 236 Spanish Bar Mine. Sparks & McClelland sand plant.	171 497 265 535 182 535 330 457 537 , 241 317
in Calaveras County. in Siskiyou County. Soda, 1924 production of. Lake. niter, in Merced County. Sodium sulphate, in San Luis Obispo County. Southern California Mining and Smelting Company. Pacific Company. Quarry. South Mountain deposit. 238, 236 Spanish Bar Mine. Sparks & McClelland sand plant.	171 497 265 535 182 535 330 457 537 , 241 317
in Calaveras County. in Siskiyou County. Soda, 1924 production of. Lake. niter, in Merced County. Sodium sulphate, in San Luis Obispo County. Southern California Mining and Smelting Company. Pacific Company. Quarry. South Mountain deposit. 238, 236 Spanish Bar Mine. Sparks & McClelland sand plant. Special articles: California foundry sands 25	171 497 265 535 182 535 330 457 537 , 241 317
in Calaveras County. in Siskiyou County. Soda, 1924 production of Lake niter, in Merced County. Sodium sulphate, in San Luis Obispo County Southern California Mining and Smelting Company. Pacific Company. Quarry. South Mountain deposit	171 497 265 535 182 535 330 457 537 71 317
in Calaveras County. in Siskiyou County. Soda, 1924 production of Lake niter, in Merced County. Sodium sulphate, in San Luis Obispo County. Southern California Mining and Smelting Company. Pacific Company. Quarry. South Mountain deposit	171 497 265 535 182 535 330 457 537 71 - 317 - 71 1–255 0–396
in Calaveras County. in Siskiyou County. Soda, 1924 production of Lake niter, in Merced County. Sodium sulphate, in San Luis Obispo County. Southern California Mining and Smelting Company. Pacific Company. Quarry. South Mountain deposit	171 497 265 535 182 535 330 457 537 71 - 317 - 71 1–255 0–396
in Calaveras County. in Siskiyou County. Soda, 1924 production of. Lake. niter, in Merced County. Sodium sulphate, in San Luis Obispo County. Southern California Mining and Smelting Company. Pacific Company. Quarry. South Mountain deposit. 238, 236 Spanish Bar Mine. Sparks & McClelland sand plant. Special articles: California foundry sands. 25 Dealers in gold-silver ores and bullion must take out licenses. 396 Directory of California Foundries. 566 Mining Law. 76 Sponge-iron, by Wakama Iron and Steel Company's process. 514	171 497 265 535 182 535 330 457 537 71 - 317 - 71 1–255 0–396
in Calaveras County. in Siskiyou County. Soda, 1924 production of Lake niter, in Merced County. Sodium sulphate, in San Luis Obispo County. Southern California Mining and Smelting Company. Pacific Company. Quarry. South Mountain deposit	171 497 265 535 1825 1835 1836 1457 1937 1937 1937 1937 1937 1937 1937 193
in Calaveras County. in Siskiyou County. Soda, 1924 production of Lake niter, in Merced County. Sodium sulphate, in San Luis Obispo County. Southern California Mining and Smelting Company. Pacific Company. Quarry. South Mountain deposit	171 497 265 535 182 535 330 457 537 71 1-255 0-396 3-572 7-121 5-518
in Calaveras County. in Siskiyou County. Soda, 1924 production of. Lake. niter, in Merced County. Sodium sulphate, in San Luis Obispo County. Southern California Mining and Smelting Company. Pacific Company. Quarry. South Mountain deposit	171 497 265 535 182 535 330 457 537 71 317 71 1–255 0–396 3–572 7–121 5–518
in Calaveras County. in Siskiyou County. Soda, 1924 production of. Lake. niter, in Merced County. Sodium sulphate, in San Luis Obispo County. Southern California Mining and Smelting Company. Pacific Company. Quarry. South Mountain deposit	171 497 265 535 182 535 330 457 537 71 317 71 1–255 0–396 3–572 7–121 5–518
in Calaveras County. in Siskiyou County. Soda, 1924 production of Lake niter, in Merced County. Sodium sulphate, in San Luis Obispo County. Southern California Mining and Smelting Company. Pacific Company. Quarry. South Mountain deposit	171 497 2 265 182 182 1 535 2 330 457 537 71, 241 2 317 71 1-255 3-396 3-572 7-121 487 487 487
in Calaveras County. in Siskiyou County. Soda, 1924 production of Lake niter, in Merced County. Sodium sulphate, in San Luis Obispo County. Southern California Mining and Smelting Company. Pacific Company. Quarry. South Mountain deposit	171 497 265 535 182 535 330 457 537 71 317 71 -255 0-396 487 -487 -222 200
in Calaveras County. in Siskiyou County. Soda, 1924 production of. Lake. niter, in Merced County. Sodium sulphate, in San Luis Obispo County. Southern California Mining and Smelting Company. Pacific Company. Quarry. South Mountain deposit	171 497 265 265 535 182 535 330 457 71 317 71 -255 -390 -390 -3-72 -121 -5-518 487 487 -222 -200 202
in Calaveras County. in Siskiyou County.  Soda, 1924 production of Lake niter, in Merced County.  Sodium sulphate, in San Luis Obispo County.  Southern California Mining and Smelting Company. Pacific Company. Quarry.  South Mountain deposit	171 497 265 535 182 535 330 457 71 71 -255 38 -572 -121 5-518 487 487 200 202 201
in Calaveras County. in Siskiyou County. Soda, 1924 production of Lake niter, in Merced County. Sodium sulphate, in San Luis Obispo County. Southern California Mining and Smelting Company. Pacific Company. Quarry. South Mountain deposit	171 497 265 182 265 355 182 535 182 535 182 536 182 182 182 183 184 187 187 187 187 187 187 187 187 187 187
in Calaveras County. in Siskiyou County.  Soda, 1924 production of Lake niter, in Merced County.  Sodium sulphate, in San Luis Obispo County.  Southern California Mining and Smelting Company. Pacific Company. Quarry.  South Mountain deposit	171 497 265 182 265 355 182 535 182 535 182 536 182 182 182 183 184 187 187 187 187 187 187 187 187 187 187
in Calaveras County. in Siskiyou County. Soda, 1924 production of Lake niter, in Merced County. Sodium sulphate, in San Luis Obispo County. Southern California Mining and Smelting Company. Pacific Company. Quarry. South Mountain deposit	171 497 265 182 265 182 265 182 182 182 182 183 184 187 197 197 197 197 197 197 197 197 197 19
in Calaveras County. in Siskiyou County. Soda, 1924 production of Lake niter, in Merced County. Sodium sulphate, in San Luis Obispo County. Southern California Mining and Smelting Company. Pacific Company. Quarry. South Mountain deposit	171 497 265 535 182 535 535 535 535 535 537 71 71 1-255 -517 71 2-217 487 487 487 201 202 202 202 202 202 524 537 537 537 537 537 537 537 537
in Calaveras County. in Siskiyou County. Soda, 1924 production of Lake niter, in Merced County. Sodium sulphate, in San Luis Obispo County. Southern California Mining and Smelting Company. Pacific Company. Quarry. South Mountain deposit	171 171 179 179 189 189 189 189 189 189 189 18
in Calaveras County. in Siskiyou County. Soda, 1924 production of Lake niter, in Merced County. Sodium sulphate, in San Luis Obispo County. Southern California Mining and Smelting Company. Pacific Company. Quarry. South Mountain deposit	171 497 265 535 182 265 535 537 537 537 71 1-255 3-396 487 487 1-255 202 201 222 201 222 535 537 537 537 537 537 537 537

	1 age
Steel plate riffles, used by Peacock Mining Company	. 316
production by direct reduction process518	5-518
Steele Quarry	
Stenshaw Mine	487
Stewart Mine	
Still Ranch property	
Stockdale granite quarry	. 368
Stockton Brick and Tile Company	. 188
Fire Brick Company	. 189
Mineral Products Company	. 200
Stone Canyon Coal Mine	. 30
, miscellaneous:	
1924 production of584	597
n Calaveras County	
in Del Norte County	. 294
in Humboldt County	
in Merced County	
in Monterey County5	3, 56
in Orange County	69
in San Diego County	377
in San Joaquin County	196
in San Luis Obispo County535	526
in Santa Barbara County	
in Siskiyou County	
in Stanislaus County	217
in Ventura County	244
Stonewall Mine	348
Strait M E Ranch	16
Strait, M. E., Ranch	3_179
ordered in Montanes Country	26
stone, in Monterey County	400
Sugar Hill Mine	. 488
Sulphur Spring on Mission Creek	
on Tassajero Creek	527
Sunderland Mine	531
Sunnyside Mine	
Sunset Plaster and Cement Company	
View Mine	
View Mille	507
Sunshine and Alviso claims	
group	429
Superior Copper Mine	289
Surprise Gem Mine	363
Swartzbaugh, J. O., sand plant	. 71
Sweetman silica deposit	376
Sweet Marie M'ne	
Sweetwater Chrome Mine	510
Sweetwater Ourome Wille	506
Sycamore Springs	
Sykes Ranch deposit	552
Table of mineral output in 1924:	
by counties_	577
by substances	
by years	
of mineral production:	
	138
Calaveras County	
Del Norte County	
Humboldt County_	
Merced County	174
Monterey County	26
Orange County	_ 60
Sacramento County	
San Diego County	
San Diego County	186
San Joaquin County	
San Luis Obispo County	502
Santa Barbara County	
Siskiyou County	
Stanislaus County	
Ventura County	
of tests on California foundry sands	
Take-a-Chance copper group	
Take-a-chance copper group	265
Tale, 1924 production	
in Calaveras County	
Tartaglia group	_ 531
Tassajara copper claim	511
Hot Springs	47

		]	Page
Tassajero group			522
Taylor, R. C., cited.			
Telluride group			
Templeton sand plant			533
Ten Eyck Placer Mines, Inc. Tests on California foundry sands, tabl of			488
Tests on Camornia foundry sands, table of			250
Thomas Mine Thompson Bar Mine			
Brick Company			
Tile (see also brick and tile).			303
in Humboldt County			301
in Merced County			175
in Monterey County			57
in Monterey County in San Diego County			358
in San Joaquin County			188
in Ventura County			237
Tin in San Diego County			353
Tiptop copper claim			511
Tollgate Mine			159
Tom Scott Mine			349
Toro Canyon Brick and Tile Company			547
Total mineral production of California by years		_577-	-5/6
Tourmaline King Mine			
Queen Mine			906
Triangle claim			129
Triple Lode Gold Mines Inc			160
Triple Lode Gold Mines, Inc.  Tucker, W. Burling	58. 223.	325.	539
cited			147
cited	75.	388.	567
Tullock Mine			160
Tungsten, 1924 production of			268
in San Diego County			353
Turner & Lloyd prospect			164
Two and a Half Mine			489
Uncle Sam Consolidated Quartz Mine			458
Union Brick Company			35
copper group			459
Mine			490
Unner Sada Spring			495
U. S. Refractories Company (see Incello Company).			100
Vallecito Western Mining Company, Inc.			163
Valley Spring clay pit			167
mineral well			168
Vance copper property			308
Vancouver Pinnacles Molybdenum Company			- 50
Ventura Cement Company deposit			240
County		_223-	-248
climate			223
ge logy_ mineral production, table of			220
mineral resources		228	-24C
mineral resources oil field development in	76, 250	388	567
streams	0, 200,	. 000,	224
tonography			223
topography transportation			225
Lime and Fertilizer Company			241
Excavating Company's clay pit			238
Rock and Sand Company			243
Velvet molding sand deposit			241
Van Wert Mine			349
Veronica Springs			
Stone Company			562
Verruga marble deposit			372
Vesa Creek Pocket Mine			
Victor Bonanza group			
Mine			
quartz prospect			450
quartz prospect			450
Virginia Cons Mine (see Corox Bros prospect)			30

The state of the s	Page
Vitrified Products Corporation	357
Volcanic ash: in Humboldt County	324
in San Luis Obispo County	537
Volk marble deposit	372
Voyle Ocher Mine	
Wakama Iron and Steel Company	515
steel process developed by515- Walker Placer	-518 490
silica deposit	
Wanda group	461
Waring, Gerald A., cited Warmcastle Soda Springs	320
Warner's Hot Springs	382
Warren Ranch prospect	535
Washington Mine Weatherby Ranch clay deposit	160
coal deposit	304
volcanic ash deposit	324
Webb and Mingus dolomite deposit————————————————————————————————————	
Weeks sandstone quarry	497
Weidman Ranch ocher deposit	214
Weitchpec Bar Mine Welch & Bradley Placer	317
Welsh Ranch deposit510,	
Western Pacific gravel pit	200
States Gas and Electric Company Stockton glass plant	193
Whistle Bar Placer Mine	489
White Mule group of mines————————————————————————————————————	232
Wilber Womble Mine (see Gold Knoll Mining Company). Wilcox Mine (see Melrose group).	
Willard Drift Mine	474
Placer	489
Willhite group 329, William Burns Placer 329,	
Tell Mine	
Williams Gold Mining Company	345
MineWillow Creek magnesite occurrence	310
Wilson Bros. prospect	461
Wingate Hill Placer	483
Winona group	
Wittenberg Mine	
W. J. D. prospect	
Wood gold prospect, Henry, prospect	
Woodfill & Barry Placer Mine	489
Wood's manganese prospect	319
Woolsey molybdenite deposit Wurst and Majors limestone deposit	402
Traible and majors minoscone depositions are properly and an are all and an are are a second and are are a second and are a s	
Yaeger Mines	62
Rock Company Volo County, oil field development in	70 76
Yolo County, oil field development in Yosemite Gold Dredging and Mining Company	181
Portland Cement Corporation	177
Zaar, Frank, Copper Mine	288
Zerfing Ranch deposit	510
Zine, 1924 production of	
in Orange County	$\frac{402}{2-64}$
in Orange County6in San Diego County6	2-64



## THE STATE MINING BUREAU

CORDIALLY INVITES YOU TO VISIT
ITS VARIOUS DEPARTMENTS MAINTAINED
FOR THE PURPOSE OF FURTHERING
THE DEVELOPMENT OF THE

## MINERAL RESOURCES OF CALI-FORNIA

At the service of the public are the scientific reference library and reading room, the general information bureau, the laboratory for the free determination of mineral samples found in the state, and the largest museum of mineral specimens on the Pacific Coast. The time and attention of the State Mineralogist, as well as of his technical staff, are also at your disposal.

Office hours: 9 a.m. to 5 p.m. daily. Saturday, 9 a.m. to 12 m.

LLOYD L. ROOT, State Mineralogist.

Third floor, Ferry Building, San Francisco, Cal.
Branch Offices: Sun Finance Building, Los
Angeles; Chamber of Commerce Building
(mail address, P. O. Box 1208), Sacramento;
Bakersfield, Taft, Coalinga, Santa Maria and
Santa Paula.



# THIS BOOK IS DUE ON THE LAST DATE STAMPED BELOW

BOOKS REQUESTED BY ANOTHER BORROWER ARE SUBJECT TO RECALL AFTER ONE WEEK. RENEWED BOOKS ARE SUBJECT TO IMMEDIATE RECALL

FEB 1 7 1981 AUG 2 0 1989 RECEIVED FEB 1 2 1981 PHYS SCI LIBRARY RECEIVED RECEIVED CED 18 1991 MAR 2 6 1981 PHYS SCI LIBRARY PHYS SCI LIBRARY OCT 2 3 1987 RECEIVED DEC 7 1987 PHYS SCI LIBRARY LIBRARY, UNIVERSITY OF CALIFORNIA, DAVIS

Book Slip-Series 458

	108700 Calif. jl. of mines & geol.	QE89 Al C3
Cali	f.	QE89 A   C3 v.21



